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SYDNEY.

Transactions of the Australasian Medical Congress (British Medical Association)

Second Session: Dunedin, February 3 to 10, 1927

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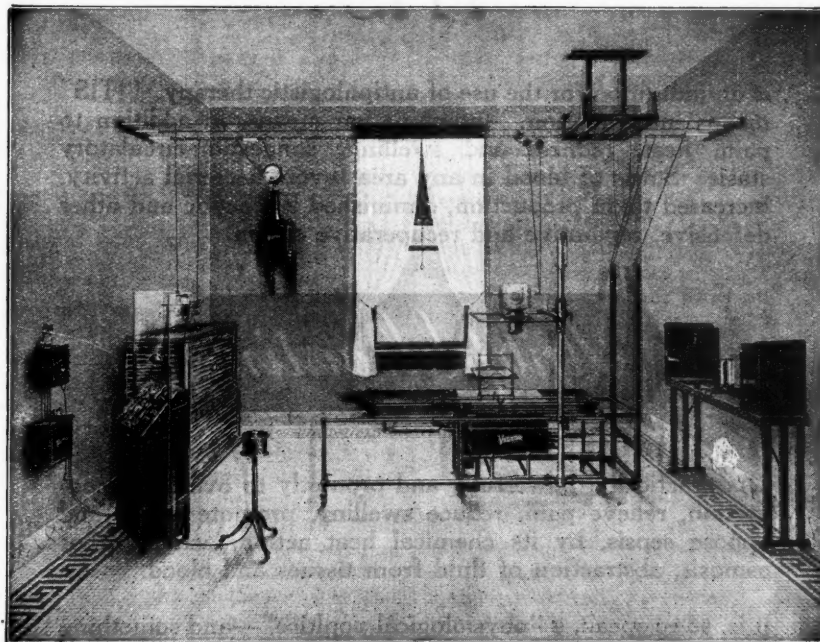
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SECTION VII.—OTOLOGY, RHINOLOGY AND LARYNGOLOGY.

THE OPERATIVE TREATMENT OF DISEASES OF THE MASTOID.

By T. A. MACGIBBON, B.A., B.Sc., M.D., F.R.C.S.
(Edinburgh),
Christchurch.

(Continued from page 416.)

The instruments used vary in the hands of operators. Some, like Fraser and Nager, are experts in the use of the chisel. Fraser holds his chisel in his fist, Nager between the thumb and four fingers. The former looks clumsy, while the latter looks more artistic. But both men make clean and light cuts and are not heavy handed. I have seen many men performing mastoid operations, but of all I prefer Lake's method with the hand gouges. This is the safest method and less likely to jar the head and cause post-operative headaches. The shavings are lifted clean away with the gouges and very fine work can be done. It may take a longer time and yet, my average time for a radical operation is fifty-five minutes. The use of a mechanical burr, dental or other sort, has gone out altogether. It was never a good method; asepsis was difficult to secure; the bone was heated and killed; the canals of the bone became filled with infected bone dust and the risk of damage to the important surrounding structures was very great indeed. The time taken was often from two to four hours. It was unnecessarily long and tedious.

Operations That Are Seldom Done Nowadays.

Ossiculectomy.

Ossiculectomy has been done in cases of obstinate discharge from the attic region where the discharge is not great in amount and is coming from a perforation in the upper part of the membrane or from the attic into the atrium as seen from a large perforation in the *membrana tensa*. The membrane is removed as completely as possible and the malleus cut away from its attachment to the walls and roof of the tympanum and drawn out with the incus which is easily detached from the fossa. There is little risk of dislocating the stapes. At the same time with attic punch-forceps the outer wall of the attic is removed, as well as all the folds of mucous membrane which might retain secretion. In a few cases

success seems to have attended this operation, but the condition of the walls of the attic and tympanum could not be ascertained and the state of the aditus and antrum was not known. It is now stated that the aditus and antrum are always affected along with the tympanum and if the operation be required, it is considered safer to do the radical operation. From an insurance point of view a man who has had ossiculectomy done, cannot be accepted as a "first-class life," whereas after a radical operation, if there have been no complications, he can be.

The old operation for acute suppuration was the cortical one; here the cells were opened into and drainage established. Some of these patients got well, but most of them according to the literature either continued to have a fistula or became so bad that the radical operation had to be performed.

When tuberculosis has been diagnosed, it is difficult to tell how much bone to remove. Apparently healthy bone may be infected and the wound will not heal up. It is my opinion that as much bone as is detachable should be removed and no more. Later on a sequestrum may form and the whole diseased area may detach itself. There are the disappointing cases and the ones which do us so much harm in the eyes of the public. Diphtheria in the bone is worse. The bone will not granulate; I have had repeated tests carried out with the result that no bacilli were found and yet the bone will not heal. What are we to do in these cases? The wound remains open and, except for slight serous discharge and the bare bone, looks well. I have twice operated in these circumstances without result, tried stimulating lotions, ionization, curetting and still no granulation results. Curetting draws a little blood and there is a feeble attempt on granulating and then everything stops. In connexion with my last patient, upon whom I myself did the second operation, I shall wait twelve months and reopen the ear and see if I can still do without the radical operation.

The Radical Mastoid Operation for Acute Mastoiditis.

The radical operation is done in acute cases only when *labyrinthitis suppurativa* is present. In the ordinary cases I find it wise to do a simple operation only. Seventh nerve paralysis usually clears up rapidly after the classical operation. I have had two definite cases of this. Cerebellar and cerebral abscesses can be approached without interfering

with the middle ear. But sometimes cerebellar abscess is due to suppurative labyrinthitis and then of course the outer wall of the internal ear must be examined. One must be careful to distinguish between pressure on the labyrinth or irritative labyrinthitis, which can be relieved with the ordinary simple operation and wait. In this connexion the new vestibular tests by Neumann and Bárány may help us to distinguish between irritation or congestion of the labyrinth and suppurative labyrinthitis. If the symptoms do not subside, then the radical operation can be considered. The after treatment of the cavity following the radical operation is important; granulations must be kept down so that there may not be a thick pad of fibrous tissue between the lining skin and the windows. I have a patient who hears ordinary conversation quite well despite two such cavities. Septa are apt to form; when they do, they are usually from portions of the membrane not removed from the sulcus. Failure to stop the discharge is a nuisance and is due to tubal infection; this is not a danger and as long as it is tubal, the patient can be accepted as a "first-class life." Of course, tubal, pharyngeal and nasal treatment should be instituted in view of the discharge. But sometimes the discharge is from an unopened cell. The worst kind is from a petrous cell which is almost impossible to get at. Occasionally it is due to an infected and discharging semicircular canal. When this is the case it must be opened widely and drained. This can sometimes be done with little injury to the membranous labyrinth.

All patients must be kept under observation for the rest of their lives after radical operations, because desquamated skin may collect when the bone will become eroded and a foul odour arise. Many a good operation has been spoiled thus by neglect.

We do not get rid of our patients as the abdominal surgeons do and we are apt to grow weary of the repeated visits, but we must keep the cavities sweet.

I have just made these notes as requested and they are but scrappy, yet I trust they may lead to a profitable discussion.

DR. E. GUTTERIDGE (Melbourne) in reference to primary closure said that they had become tired of prolonged dressings at the Children's Hospital in Melbourne and had tried a series of thirteen patients in which the mastoid wound was closed primarily; they were all successful. They had then had a few in which this treatment had been a failure. The procedure was primarily closure except when there was an abscess. If the temperature remained high and there were any signs of suppuration the wound was opened and plugged. He spoke of the importance of nasal infection and said that if necessary tonsils and adenoids should be removed early. For chronic suppuration they gave a long course of treatment with drops and douches and finally zinc ionization, the Bondy method. Radical mastoid operations were very uncommon at the Melbourne Children's Hospital, only after other methods of treatment had failed were patients operated upon and in all skin grafting was done.

DR. J. HARDIE NEIL (Auckland) was in favour of early opening in definite mastoiditis. The bad results that were reported to have ensued were due to the original virulence of the infection. He considered that hæmorrhagic mastoiditis was of very serious import. It generally

meant a virulent infection at times with acute bacteriæmia and often a terminal lung infection and death. He found radiography very useful. In acute mastoiditis with disintegration, a good procedure was to put in an adrenalin pack and to wait for five minutes to get clear demarcation. As to early closing of the wound each case must be judged separately. It was sometimes advisable, but not when severe constitutional symptoms were present. He had found Heath's operation useful in some cases; one great advantage was the conservation of hearing when the other ear was affected. He did a radical mastoid operation when signs of meningeal irritation rendered the operation imperative. In skin grafting he used Thiersch grafts and a collodion preparation. He considered sclerosis of the mastoid pathological. The cellular and diplastic types were degrees in pneumatization.

DR. W. N. ROBERTSON (Brisbane) said that he did not consider early closure of the wound a good surgical procedure, but he had done it successfully in a few cases where time was of the greatest importance. For Heath's operation he always used a large rubber tube to prevent contraction of the meatus. In one patient with cholesteatoma, a girl who had been brought into the hospital unconscious and who had suffered from facial paralysis for two years, after opening up the mastoid and washing out the cholesteatomatous material he had found the facial nerve exposed in the bottom of the cavity. In six months time the girl had recovered power in the nerve. He approved of Fraser's skin graft, a huge graft packed in with knitting wool soaked in bismuth-iodiform-paraffin paste. The patient generally left hospital in a week after operation. Tubal infection was the bugbear of all radical mastoid operations. He had tried to peel off the mucous membrane of the tube and to push it down so as to make a kind of cork. Nasal infection should be sought. Since medical inspection of school children had been introduced, there were fewer cases of mastoiditis because tonsils and adenoids were removed early.

DR. H. J. GRAY (Perth) asked how strict aseptic precautions in opening the drum were obtained. He had found radioscopy helpful in many cases. He liked a more posterior incision than that recommended by Dr. MacGibbon and found a large wooden mallet much less tiring.

DR. E. L. MARCHANT (Wellington) favoured turning in whole tissue flaps instead of skin grafts. There was a much smaller cavity and subsequently less treatment.

DR. R. PULLEINE (Adelaide) mentioned a patient with cholesteatoma and facial nerve paralysis in whom after removal of the cholesteatoma rapid recovery of the facial nerve ensued. True cholesteatoma was a rare disease. What was called cholesteatoma was simply hyperkeratosis growing through the tympanic membrane causing pressure necrosis and a foul odour. The patients with hyperkeratosis were the people who got ivory mastoids. In regard to the incision the hæmorrhage was much less troublesome if cocaine and adrenalin were injected into the site five minutes beforehand. Beck's clamps were often used to control bleeding. Macewan used a trephine and then burrs and sharp spoons and considered the use of a chisel criminal. A large wooden mallet and wooden handled gouges prevented jarring. His procedure in acute mastoiditis was to open up the antrum and to make sure there was no infected cell in the tip and then to sew up. He used a piece of fine rubber tubing doubled over for drainage. He disapproved of any operation for tuberculous mastoiditis; it rarely did any good. He used iodoform and iodine in this condition.

Ossiculectomy for non-necrosed ossicles should be relegated to the limbo of the past. Radiography of the mastoid gave a good idea of pneumatization and whether pus was present. He found transillumination in a perfectly dark room with the aid of the small lamp of an electrical ophthalmoscope in the meatus and a comparison of the two sides of value in children.

DR. T. A. MACGIBBON in reply said that he did not consider primary closure a justifiable operation. The surgeon could not be sure that the blood clot was free from infection from the middle ear. Unless complications were present he thought that radical mastoid operations in children were not justifiable. He removed the apex of the mastoid, but not the actual tip, so that a Y-shaped attach-

ment of the sternomastoid remained. For cleansing the meatus he used ether, warning patients that it would sting. After paracentesis he used "Lysol" solution and then dried thoroughly with swabs of cotton wool. As to cholesteatoma, continental surgeons examined the aural discharge for cholesterol crystals and when these were present, they performed a radical mastoid operation.

CONSERVATISM IN THE TREATMENT OF MIDDLE EAR DISEASE.

By ROBERT PULLEINE, M.B., Ch.M. (Sydney).
Lecturer in Otology, University of Adelaide.

By conservative treatment we mean treatment undertaken to restore function to the possible limit without surgical intervention. Any one who has been in practice a long time, must have observed that the results of operations on the ear even by great artists have not always been ideal. Education as to the necessity of early paracentesis is proceeding, but there are still too many practitioners who tell the patient or his parents to poultice the ear until the abscess breaks, but as this may take several days to happen, no words can describe the long sustained agony.

I teach students that the paracentesis should be done at the very beginning, as soon as there is pain, redness and convexity.

The operation is harmless and there is no need to wait until we are sure that there is pus and until all the tympanic landmarks are lost.

Iodine as a counter-irritant over the mastoid is still widely used, but a dressing of nitrate of mercury ointment made up with cacao butter of the United States of America Pharmacopeia and used in a strength of one to six is a most potent agent. There is a rapid absorption and we know that the mercury causes intestinal symptoms in a few hours if it is pushed too far. Unfortunately when a patient with an acute ear condition is referred to us, the infection of the mastoid is often too far advanced for resolution to be expected, but even then it is well to be conservative in our interference, limiting our surgery to opening and draining the mastoid antrum on the same principles as any other bone abscess without undue exenteration of the parenchyma. We must make sure, of course, that the apical cell is not infected. But I am more concerned with the treatment of chronic middle ear disease. The younger the otologist is, the more likely is he to consign a chronically discharging ear summarily to surgical interference. He learns by experience that such interference may be useless and even harmful.

Now besides chronic mastoid infection, there are several factors that act in keeping up discharge. There is hyperkeratosis of the middle ear and attic in which epithelial invasion fills every nook and corner with branny scales which when moist macerate and become infected with saprophytes, giving rise to pain, irritating discharge and often secondary infection of the external auditory meatus.

Associated with this are often small polypi and granulations on the promontory, ossicles or posterior meatal wall close to the tympanum (not cholesteatoma). Then there is the patent Eustachian tube with or without infection with the characteristic perforation in the lower anterior quadrant of the membrane.

We must not forget the naso-pharyngeal complications in children or a possible suppurating sinus in adults.

Treatment.

Obviously we must make sure that the ventilation of the tympanum and the removal of the septic foci is carried out before our therapeutic armament is used.

This consists of pertubal lavage with the anaesthetic apparatus, high pressure syringing, zinc ionization, iodine vapour insufflation, ear baths of alcohol, Dakin's "Zonite" solution, "Mercurochrome" and aluminium acetate, closure of the Eustachian tube and closure of the tympanic perforation.

The pertubal lavage is carried out with a catheter and Siegel's speculum on the respective tubes of the blower and intake of the ordinary Sanborn apparatus. I find the standard citrate solution as good as any thing to pass through. More universally useful and effective is the high pressure syringe of which I present a rough diagram. In hyperkeratosis this has given me the greatest satisfaction for years. Having made full use of these cleansing agents, we can then use zinc ionization which I can testify has been a most valuable therapeutic agent, the electrolyte being a 2% zinc salt, the current three milliampères. Under this I have seen the most obstinate and offensive otorrhœa disappear. The iodine insufflation method to which our attention was directed by Brown, of Minneapolis, is the treatment *par excellence* for tuberculous otitis media and for reaching infection in the Eustachian tube.

Ear baths must be preceded by thorough cleansing and the application of adrenalin (to open up the cavities).

Then we may use the following:

In fetid discharges, Dakin's solution in the form of "Zonite" used pure or diluted just before the termination of the bath. It is a good plan to add a drop of peroxide of hydrogen to liberate the chlorine.

When there is a tenacious secretion which has difficulty in pushing its way through a perforation, peroxide and aluminium acetate 8% are valuable in combination, whereas aluminium acetate and absolute alcohol in equal parts have a very astringent and coagulating action on the profuse, slimy secretion obviously coming from the antrum through the iter.

"Mercurochrome" has an apparently beneficial effect on chronic attic suppuration showing external evidence with sparse secretion and little odour.

The treatment of hyperkeratosis can be successfully carried out, if the epithelial flakes are never allowed to collect and macerate. This may require monthly or bimonthly treatment for a year or two,

but the result is worth while. The ear remains perfectly dry for an indefinite period, always provided that the Eustachian tube is not patent. To this end we must close the tube with Alexander's rasps, if there is no reasonable outlook for closing the tympanic defect which in these patients is usually a large one.

After that the most important recommendation is to avoid any infection from baths by occlusion of ear by a stopper of greasy wool.

DR. T. A. MACGIBBON (Christchurch) said that he used 10% nitrate mercury ointment a great deal, especially in furunculosis. This was much weaker than the ointment used by Dr. Puleine. He had found ether useful in hyperkeratosis. He had used zinc ionization and had found that if the discharge were sero-purulent or purulent it was valuable, but when the discharge was mucoid or muco-purulent he did not get good results. Bad escharotic effects might be caused by iodine vapour in the middle ear. He found a 2% solution of silver nitrate a very good agent.

THE MANAGEMENT OF ACUTE OTITIS MEDIA.

By HAROLD HAYS, M.D., F.A.C.S.,

Consulting Otolologist, Sing Sing Prison and St. Joseph Hospital, Far Rockaway, New York; Director of the Park West Hospital, New York City.

For the experienced otologist the management of acute *otitis media* should not be a difficult matter. Although the treatment will vary with the experience of the individual man, certain definite principles must be kept in mind. However, it is a sad commentary on the practice of medicine that the general practitioner is lacking in his knowledge of middle ear pathology. One would not worry because of this fact if it were not that he often procrastinates before calling in the specialist with the result that any infection in this small cavity sometimes extends to the mastoid cells and the possibility of relieving the patient by palliative treatment is often absent. However, I would far rather deal with the practitioner who admits that he knows nothing about the middle ear and allows me to handle the case, than with the man who refuses to admit that he knows little or nothing, and allows me to see the patient in consultation only when serious symptoms arise. Such a man is unfair to himself, he is unfair to the patient and unfair to me.

The interpretation of symptoms of acute *otitis media* is most important. If one could go by classical symptoms, there would be little trouble, but unfortunately symptoms vary considerably and even the best specialist finds himself in trouble. For example, a young boy of ten complained of a pain in his ear. A slight congestion of the drum was found. It was not deemed necessary to open the drum. There were no symptoms of mastoiditis. Within one week, he died of meningitis. In another case the patient refused to have a bulging drum opened. During the following week, he had little pain in his ear and had no fever. However, the drum

was inclosed. For the next ten days, there was a profuse discharge of pus. There was no indication of a mastoid condition. The X ray picture did not show the mastoid to be severely involved. Because of a severe pain in the head, the mastoid process was opened up. Pus was found, but it was too late. Two days later, the patient died of meningitis. These two cases come to my mind at the present time, but they are only two of hundreds of exceptions to the general picture of acute *otitis media*.

Grave consideration must be given to two facts. The first is the symptoms of which the patient complains, and the second is the proper examination of the *membrana tympani* and mastoid process.

What are the particular symptoms which are of importance? Pain and raised temperature. In almost all cases the patient has been suffering from some intercurrent disease, such as influenza, so that his general resistance is below par. It is but natural that he is unable to withstand an infection. In other words an infection of the middle ear which takes place in a patient who is suffering from such disease, is far more serious than it would be in the patient who gets an infection while his system is in good condition. For example, the bather who infects his middle ear while swimming, is more likely to get well without a complication than the little patient who is bed-ridden with scarlet fever.

The pain in almost all cases is quite severe except in young children. Yet I have seen many exceptions to this rule. One patient will present himself merely with the symptoms of a stuffy feeling in the ear, while the next will have such excruciating pain that he is unable to stand it. If I had been able to see such patients before the onset of the symptoms, I have no doubt that I would have found that the first patient had a moderately relaxed ear drum which would allow of a great deal of tension on the drum before pain would have been felt. However, in spite of pain being a predominating symptom, the worst case of middle ear infection that I have even seen, was in a child who never had any pain. I was called in to see the child because of a diminution in hearing. Both middle ear cavities were filled with pure pus.

Temperature is a fair guide to the severity of the infection in many cases. In children the temperature is immediately very high, while in adults it may not rise above 38.3°C. (101°F.). As a rule the fever does not last many days after the drum is properly incised, unless the process is progressing until it reaches hidden recesses in the mastoid bone from which no drainage can take place. I place little reliance on the raised temperature during the first few days. It is to be expected. But if the fever persists, one must watch the patient very carefully. Again one meets exceptions to this general rule. There are definite cases which I have termed latent mastoiditis, cases in which there are absolutely no symptoms except the discharge from the middle ear. There is never any fever. Yet such cases end up in a mastoid operation because there seems to be no other way of ridding the patient of a destructive process. Two years ago I was treating three chil-

dren who had been suffering from acute *otitis media*. Every symptom had subsided except the discharge from the ear canal which continued to be profuse. Repeated X ray pictures showed a progressive destructive process within the mastoid bone and every one of these children had to be operated upon. In former years no doubt we should have been willing to watch these children over a considerable length of time, but with the advent of radiography such practice is pernicious and one can often be guided in a case of acute *otitis media* by pictures taken every second or third day. In spite of the fact that the skiagram may be misleading at times, there is little doubt that it is of value when the pictures are interpreted in conjunction with the other symptoms.

In the past we have been satisfied to classify all cases of acute middle ear inflammation or infection as acute *otitis media*. Such a classification means nothing and is unsatisfactory because it is not determined on a pathological basis. Because of this fact, I have attempted to reclassify the middle ear diseases and I have termed the acute cases of middle ear disease as acute tympanitis (if the drum only seems to be involved) or acute *otitis media* with exudate or with suppuration. Of course, one cannot determine what is behind the drum until a spontaneous rupture occurs or until an incision is made. After a discharge from the middle ear does take place, the amount and character of the discharge is of a great deal of importance.

In the majority of cases the inflammation in the middle ear is accompanied by an exudate, a thin watery secretion which may or may not contain virulent organisms. From day to day this discharge may vary in quantity. It is always important to take a culture of it because the type of organism may determine one as to the seriousness of the condition. Within a few days the discharge will turn into pus (acute *tympano-otitis media* with suppuration) unless there is a tendency for the process to subside. If this discharge is very thick and there is a suspicion of some retention, one must be on the look-out for an extension to parts beyond the middle ear cavity. Yet I have seen patients in whom there was a profuse discharge for weeks, with slight rises of temperature and real pain over the mastoid processes, get well without a mastoid operation. On the other hand, I have seen other patients in whom there was practically no discharge from the middle ear, suddenly develop severe intracranial complications, so that it was impossible to save them. Again one must realize that there are grave exceptions to the general rules.

If definite symptoms do present themselves, what shall we do in the management of these cases? Of primary importance, of course, is the establishment of as free drainage as possible which means a wide and extensive opening of the *membrana tympani*, sometimes even when spontaneous rupture has occurred. It has been my experience that the spontaneous opening in the drum is seldom in the best place for drainage.

If the drum has to be incised, an anæsthetic should invariably be employed, no matter how young the patient. It happens that certain adults can withstand the pain, so that the operation can be performed with a local anæsthetic or no anæsthetic at all, but this seldom happens. If a local anæsthetic be used, the best one is equal parts of cocaine, carbolic acid and menthol. Drops of this solution are instilled into the ear canal and allowed to remain in contact with the drum for ten minutes. After the operation, the canal should be doucled with a weak alkaline solution. However, one should, if possible, use a transient, general anæsthetic, such as gas or ethyl chloride. One often hears that ethyl chloride, used as a general anæsthetic, is dangerous, but I firmly believe that if it is applied on an open, loose handkerchief, one need not be apprehensive. I have used it in thousands of cases, particularly for incising the ear drum and for opening a peritonsillar abscess and have yet to see the first accident.

The incision in the drum should be a sweeping one extending from the upper posterior part, forward and downward and then upward toward Schrapnell's membrane. One need not fear that one will make too large an incision. Within twenty-four hours, most of the incision will have closed. Then one should observe the drum carefully to see that there is little or no retention. If the first incision has been properly made, it is seldom that one has to open the drum again. I have frequently heard of the necessity of incising a drum a number of times, but it has been my experience that if there is good drainage from the primary incision, one will accomplish little by trying to enlarge it a second time. If serious symptoms arise, one may rest assured that the infection has gone beyond the confines of the middle ear cavity.

After the drum has been incised, it is most important to watch the patient carefully. Whether he should remain in bed or not, whether he will be able to come to the office¹ for special treatment or whether he will be able to go about as usual will depend upon his general condition and the way the middle ear is behaving itself. In the majority of cases the symptoms will subside to a great extent after the incision and it will be hard to hold the patient down. In my experience, 90% of patients will get well without any severe treatment after the incision in the drum has been made, except in the winter months when there is a great deal of infection, particularly of the influenza type. In those severe cases which need careful observation in order to discover a possible mastoid complication, the patient should be under daily observation and receive the benefit of any and all kinds of treatment which might ameliorate the condition. Of most importance is the following up of the case with X ray pictures which may have to be taken every few days. A few months ago, for example, a child was brought to me with a discharge from the middle ear which was quite profuse and the history of pain, high temperature and tenderness over the mastoid

¹ The American term for consulting room.

process for about a week. The condition of the middle ear warranted one in feeling that an operation on the mastoid process would eventually have to take place. The first X ray pictures showed some clouding of the mastoid cells, but no breaking down of the trabeculae between the cells. A second picture, taken a few days later, showed the same condition. Further pictures, taken at intervals of a few days, showed that the process was subsiding and, within two weeks, all the symptoms disappeared and he is perfectly well today.

But I am sure that you are particularly anxious to know how I treat these cases. Whether the process gets well without further intervention than the incision in the drum or whether the case goes on to serious complications depends upon the will of the Almighty. Whatever one does is in the way of indirect treatment for, at this stage, one cannot attempt to get directly into the middle ear. I shall take it for granted that the patient is instructed to keep the middle ear and canal clean by frequent douches. The kind of solution used, its temperature and so forth are of very little importance, but what is of importance is to see that the ear is kept clean and free from any retention. I do not feel that antiseptic solutions, such as bichloride of mercury, have any particular advantage and they have a tendency to irritate the ear canal. If the discharge is very thick, the patient will accomplish a great deal by wiping the ear clean with pledgets of cotton wool on a tooth pick or by having suction used on the canal and middle ear.

The observation in the physician's office and the treatment given there will often help a great deal. Among the specific treatments which I find of value are the following. Comments will be made about each one:

(i) Cleansing, (ii) zinc ionization, (iii) "Acri-violet" solution, (iv) Mercurochrome, (v) Local vaccine therapy, (vi) ultra-violet ray treatment, (vii) restoration of hearing therapy.

Cleansing and Abortive Treatment.

Before one has determined that an incision in the drum is necessary or when the primary symptoms develop and a mild, inflammatory condition of the drum only seems to be apparent, one may be able to abort the condition by a very simple form of treatment which is particularly efficacious in young children. The head is turned to one side and five drops of the following solution are instilled into the ear canal and allowed to remain there for five minutes:

Adrenalin 1% 3-6 mils (one drachm),
Menthol 0.3 gramme (five grains),
Cocaine 0.5 *quantum sufficit* ad 30 mils (one fluid ounce).

Five drops to be instilled into the ear every half hour.

In a number of cases I have found that this solution will abort an inflammation in the middle ear, no doubt by its ability to penetrate through the drum and shrink up the otitic opening of the Eustachian tube, so that drainage of any fluid in this

cavity will take place into the throat. Of equal importance is the irrigation of the ear canal with a solution of about 43.3°C. (110°F.). It makes little difference what the solution is, as I said before, provided that it reaches the drum and exercises its soothing effects. After the drum has been incised and there is a free discharge, particularly if this discharge has a tendency to become thick and tenacious, irrigations are most necessary. One should never allow any retention. As a rule, I advise irrigations of boric acid or plain salt solutions every two to three hours, using a return flow glass tip or, when there is a sufficient opening in the drum, the Fowler ear douche which allows of a certain amount of suction.

Zinc Ionization.

I am firmly convinced that zinc ionization is a method of treatment which is more than worth while, more in the subacute and subsiding stage than at the onset of the process. You, no doubt, know that the ionization of zinc allows of the penetration of the metal with very effective results on the tissues. The process is very simple and the method can be used for the treatment of any partially closed cavity, such as the middle ear and the antrum. If two electrodes are connected with a galvanic current (an ordinary rheostat will do the "trick" or two dry cells) and the terminals immersed in a 2% zinc sulphate solution, one will notice that there is a disintegration of the fluid and that zinc ions will be given off the negative pole. In this method of treatment the ear canal is comfortably filled with zinc sulphate solution and the negative electrode placed in contact with it. The positive contact is made by a sponge applicator held in one hand. The current is turned on and gradually increased until the patient feels a slight burning sensation. It is allowed to remain at that for about fifteen minutes, then turned off and the canal wiped dry. There is often a sensation of dizziness when the patient assumes the upright from the recumbent position, but there are no other disagreeable symptoms. Treatments should be given every day or every other day.

Acri-Violet Solutions.

Within recent years excellent reports have been made about the antiseptic effects of neutral "Acri-flavine." Churchman proved that this new dye was particularly valuable in combating infections due to the Gram-negative bacteria. He also stated that gentian violet was an excellent antiseptic against the Gram-positive bacteria. He combined the two dyes in equal parts. The results have been astonishingly good. About four years ago, we began to use this dye in such combination, mixing a capsule composed of 26.4 milligrammes of each of these dyes in one hundred cubic centimetres of water. Drops were placed in the ears two to three times a day. The solution must be made up fresh every few days as it is not stable. The stains may be washed out with dilute alcohol. I feel positive in my own mind that this antiseptic has a good effect upon acute middle ear conditions and Abrahams

and Herzig claim that some of the solution can be seen in the throat after it has been instilled in the ear canal, thereby proving that it has percolated through the perforation. Although, perhaps, these two specialists were the first to bring the value of this combination of dyes before the profession, under the name of "Acrid-violet," I am sure that we were among the first to use it in nose, throat and ear conditions.

Mercurochrome.

The antiseptic qualities of mercurochrome have been ably demonstrated. I use it constantly, but am of the opinion that I obtain better results from the "Acrid-violet" solutions. The one advantage of mercurochrome is that it is more stable.

Local Vaccine Therapy.

During the past two years, I have reported upon the value of the use of vaccines locally before the American Medical Association and before the New York Academy of Medicine. This subject was brought to the attention of the medical profession by Professor Besredka of the Pasteur Institute who used it to prevent typhoid epidemics. It is beyond the province of this paper to go into details here. Suffice it to say that the vaccine is easily made in any well equipped laboratory and can be used for any number of nose, throat and ear conditions. The secretion from the affected part is placed in a bouillon solution containing a small amount of sugar. It is allowed to grow for two days. One hundred and twenty cubic centimetres of the solution are transferred to a sterile bottle and a few drops of tricresol added as a preservative. This vaccine thus contains all the bacteria from the infected parts, plus the products of such bacteria, plus the solution in which the growth has taken place. Therefore, one does not have to isolate the predominating bacteria and depend upon them to do the work as must be done with vaccines given hypodermically. In acute or subacute ear conditions the vaccine is used as drops in the ear canal three to four times a day. In other conditions it is applied on pieces of cotton wool or gauze, flattened out and placed as near the infected part as possible. For more detailed description you are referred to my more recent papers on the subject.

Ultra-Violet Rays.

The radiations of ultra-violet rays have a great deal of value in various ear conditions when the water cooled lamp is used, but they are of little value in acute conditions which have a tendency to get well without it. There is no doubt that they have an antiseptic effect, but only if they reach the infected part directly. They work more efficiently if they are applied in combination with one of the dyes such as "Acrid-violet," because the rays have a tendency to follow the paths of one of the dyes.

Restoration of Hearing.

When in acute *otitis media* the discharge has ceased, the physician's duty does not end. There is seldom a time when there is not some diminution in hearing and the hearing must positively be re-

stored to the normal. As soon as there is a subsidence of the discharge, the hearing should be tested, preferably by the audiometer. With this machine one can obtain an accurate curve of the patient's hearing. When the process shows the proper resolution, the hearing may be improved by proper politization if the tube is patent. No force should be used. If the tube is not open, it may be catheterized or if no air reaches the middle ear in this way, one may have to have recourse to treatment of the tubal mucosa by direct applications of silver nitrate and the insertion of various sized bougies. Under no circumstances should one be satisfied that the patient is completely cured until the hearing is brought back as near to the normal as possible.

In the natural course of events a certain number of patients will suffer from an acute *otitis media* which lasts longer than a reasonable length of time. The patient complains of no symptoms except the discharge from the ear, but at the same time the general physical condition remains below par. The X ray picture may show little involvement of the mastoid process. The hearing is considerably diminished. Should one be content to let the process continue with the possibility of a complication taking place and a certain permanent loss of hearing or should one insist upon operative interference which means the exenteration of the mastoid cells? I firmly believe that an operation in such cases is the conservative procedure. There is seldom any risk and often in adults the operation can readily be performed under local anaesthesia. Almost always the discharge ceases after the first few days and one frequently has such patients out of bed on the third or fourth day and the wound completely healed at the end of a week.

Conclusions.

The proper examination and the proper interpretation of symptoms in acute *otitis media* is of the utmost importance.

The taking of frequent X ray pictures makes an excellent guide showing one the gravity of the symptoms.

One may be guided by the temperature and the pain, but such symptoms are often misleading.

Certain antiseptics, particularly the newer dyes, and the use of vaccines locally will often help in retarding the process.

After resolution has taken place, one must not be content until the hearing has been brought as nearly to the normal as possible.

DR. T. A. MACGIBBON (Christchurch) discussed the expense of frequent X ray examinations and thought the skiagrams taken in Christchurch were not good enough to be of much use. He agreed that abortive drops were often useful. Mixed vaccine treatment was unscientific and the combination of dyes was not good.

DR. H. J. GRAY (Perth) said that he found "Flavine" very good and would continue to use it.

DR. J. HARDIE NEIL (Auckland) considered that Dr. Hays's paper was a complete exposition by a master of otology. It appeared that in America they had more patients with acute *otitis media* than in New Zealand. The infection was probably more virulent. He discussed

the cause of pain in the throat and in the back of the neck during zinc ionization. He concluded that it was due to electrical reaction. In acute *tympano-otitis media* a meatal adrenalin pack for five minutes frequently permitted a better definition of the landmarks and was very useful to those working in hospital clinics.

SECTION VIII.—NEUROLOGY AND PSYCHIATRY.

THE TREATMENT OF THE VOLUNTARY PATIENT AT MENTAL HOSPITALS AND PSYCHIATRIC CLINICS.

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THERE is no doubt that the Dominions of the British Empire are ahead of the mother country in the provision which they have made for the treatment of mental and nervous patients on a voluntary basis. Encouragement is given to patients to seek voluntary admission to mental hospitals and there are few legal difficulties in the way of admission such as exist in Great Britain.

The result is that patients are received at the hospitals in an earlier stage of their illness and, therefore, there is more chance of successful treatment. Moreover, the hospitals which cater for the milder cases, naturally tend to become more like general hospitals and this is the direction in which mental hospital reform is most urgently needed. The terms "hospital for the insane," "asylum" among others have been strong deterrents against the public allowing their mentally sick to be sent to institutions and the hospitalization of the asylums is a most essential reform.

There is no reason why mental hospitals should not be managed on very similar lines to general hospitals. There should be a staff of consultant psychiatrists and also of consultant physicians and surgeons, so that the same care could be taken of the physical examination of patients in mental hospitals as in general hospitals. The various special departments of the general hospital should be available to the mental hospital.

The facilities for the treatment of acute and early mental disease should not be hampered by a number of patients with chronic forms of insanity. The latter should be segregated in separate hospitals where colony life is available to them rather than in old fashioned wards and airing courts where employment is not available. These colonies should be situated out of the cities.

Under such conditions there would be little difficulty in persuading persons suffering from mental affections to seek early treatment in suitable hospitals. Patients with nervous and mental diseases can be divided into three categories: First, those who are anxious to receive treatment, secondly, those who are indifferent, and thirdly, those who have no insight into their illness. The first will readily go to hospitals if they are made comfortable and if the environment is not rendered unsuitable

by the presence of acutely delusional and disorientated patients. The second will certainly refuse to have treatment in hospitals that are not congenial and the third can generally be made to do what their friends consider the best for them. But the law will still be necessary to compel certain insane persons to be detained for treatment.

If the facilities for treatment are made as comfortable in hospitals for mental patients as they are in general hospitals, there will be little difficulty in arranging for the treatment of all three groups of patients.

The Early Treatment of Mental Disorders.

Well organized psychiatric clinics will more than any other means enable us to apply treatment to mental illnesses in their earliest stages. Such clinics, being attached to general hospitals, encourage the public to look upon nervous disorders in the same light as medical and surgical diseases. There is no difference made in the out-patient department of a general hospital between the nervous and the other types of out-patients.

A maximum number of patients can be treated at a minimum cost by means of the out-patient psychiatric clinic. Treatment is given in a manner that makes it easily obtainable and without interfering with the patients' social and domestic obligations. It permits them to carry on their work during the treatment and to remain in the community.

Most psycho-neuroses are due to inability on the part of the patient to adapt himself to his environment. The advice given at the psychiatric clinic will help him to overcome these difficulties before he develops wrong ideas and wrong habits and will prevent worry and anxiety that are out of all proportion to the real facts. If relief can be obtained without admission to hospital, much discomfort and expense has been saved both for the individual and for the State.

School teachers, ministers, magistrates, general practitioners can all be given expert advice at the clinics regarding problems that are to them extremely difficult and thus many patients are helped in the early stages of their illness, so that further trouble is prevented.

Of course the psychiatric clinic should always have a number of beds attached to it in association with the general hospital. There are many patients who cannot be given satisfactory attention in a few minutes, and therefore further investigation is essential. There are also many who are treated very much more satisfactorily away from their home environment, and a short stay in hospital under proper conditions will allow of their adjusting their difficulties in such a way that mental breakdown is avoided. A short stay in a psychiatric clinic is, therefore, a much cheaper investment than a long period of detention in a mental hospital.

Many patients attending the out-patient clinic only need moral advice and they are then able to deal with their domestic and social difficulties quite well. But in many cases the illness is due to the home environment. Especially is this so with hysteria in connexion with which we so often find a too

sympathetic environment leading to a desire on the part of the patient to obtain more sympathy, this being most readily given by the parents and friends to the sick member of the household. The removal of the patient from such an environment is the most important part of the treatment.

The Teaching of Psychiatry.

From the point of view of the teaching of psychiatry the psychiatric clinic is of the greatest importance. Medical students must be taught to realize that mental illness is most frequently a maladjustment of the patient to his environment. The asylum is the wrong place to give the student an introduction to psychiatry. There he will be shown the extreme stages of various mental conditions, but when he becomes a general practitioner he will meet patients with domestic and social problems and if he is unable to detect the early stages of mental derangement and to give satisfactory advice, he will fail to prevent the onset of serious mental disturbances.

In the out-patient department of the psychiatric clinic the student will see the early indications of nervous disorder and will be shown how to help patients to adjust themselves to their difficulties. He will gain experience in deciding which patients should be encouraged to overcome their troubles in their own environment and which should be advised to discontinue work and seek hospital treatment.

The general practitioner has no facilities for treating the insane and he is therefore quite ready to hand over such patients to the trained psychiatrist. Therefore, in the over-crowded curriculum of the medical school there is not much to be gained by teaching the differential diagnosis between various forms of mental disorder. The main teaching should be in the direction of assisting the general practitioner to understand the psychology of the patient and to recognize the early stages of maladjustment of the personality to the environment.

If the medical practitioner is able to give sound advice in the early stages of mental disturbances or even if he can detect such early disorders and refer them to trained psychiatrists or to hospital clinics, he will be carrying out a most important part of preventive medicine. Therefore, psychiatric clinics furnish the best facilities for medical students to acquire a knowledge of the early stages of mental and nervous disorders.

The student must be taught to understand that mental health depends upon a state of equilibrium between the instinctive tendencies of the individual and the forces by which they are controlled. Mental disorders are failures of the maintenance of this equilibrium and the illness represents the attempt to solve the problem.

Mental disorder is the reaction of a psychophysical organism to the environment. The disorder is the result of cause and effect and the student must be taught how to analyse the cause of mental disorder in order that the treatment may be based upon a proper foundation. When the mental disorder has a physical basis, such as in general paralysis of the insane, the treatment must be along

physical lines; when there is a constitutional defect such as in the case of a cretin, the underlying endocrine deficiency must be supplied; but when the cause is a psychological one, then the wrong conviction existing in the patient's mind must be treated on psychological lines.

If a student is able to analyse these causes, he will then be able to apply the correct line of treatment. It is only by studying the early cases that he will be able to obtain this experience.

The Training of Social Workers.

The clinic is an important training ground for the social worker. As the problem of early mental disorder depends in a large measure upon the proper adjustment of family situations, many of the problems are complicated and involved and cannot be properly investigated by the physician. The assistance of the social worker is necessary and the training of persons who are able to visit the homes of the patients and find out the causes of irritation, is of great importance. The trained social worker can do much to assist the patient to meet the demands of his environment and this work requires personality, judgement and experience.

Patients who are discharged from mental hospitals, should always be referred to psychiatric clinics in order that steps may be taken to prevent relapse. The social worker can do much to watch the patient's interests after discharge from hospital.

Occupational therapy is a valuable adjunct to the treatment of early nervous disorders and teachers of arts and crafts can be very usefully employed in this department. Various types of physio-therapy are also needed in the treatment, not only as physical stimuli, but as means of suggestion.

The development of out-patient clinics is the most important aspect of mental hygiene, but it is readily seen that it is very difficult to obtain the necessary personnel for the staff of such clinics, because psychiatrists, social workers and nurses with experience of nervous disorders exist in numbers that are in no way in proportion to the demand. Therefore, we must as soon as possible take steps to train the staff necessary for such clinics and when this work is properly undertaken, it will be of such interest to the workers that there will be any number of volunteers forthcoming. Psychiatry has not attracted candidates in the past because it has not held enough interest for them, but when mental and nervous disorders are looked upon in the same light as other aspects of medical science and medical students are given training that will allow them to see the psychological problems which confront mankind, there will be any number of volunteers available to carry out the work.

Types of Patients Treated.

In the psychiatric clinics of Sydney we find that the majority of patients who come of themselves, or are referred by other doctors, falls into the group generally labelled "neurasthenia." These patients, as a rule, need encouragement. The long tradition

which has been built up round the bottle of medicine, still exists and will continue to exist and therefore such patients are very disappointed if they are not given some drug treatment. The value of the drug is largely due to a conviction held by the patient regarding the efficiency of drug treatment and in this form of treatment suggestion is applied in a very inexpensive manner three or four times daily, until the next visit to the clinic. Therefore, although many cases are psychological and due to maladjustment, the value of drug treatment is not to be overlooked.

The patients suffering from hysterical manifestations are numerous. Many of them have compensation claims pending. These patients rarely improve before the question of compensation is settled and they generally attend the clinic for a very short period after that settlement. Most hysterical patients can be treated at home and as they are very suggestible, any treatment that is given them must have dogmatic assurance behind it that the patient will certainly benefit. In many cases, however, hysteria is due to an unsatisfactory home environment and therefore a large proportion of these patients need isolation in the beds of the clinic. Weir Mitchell treatment is of great value in these cases. After the patients have been in hospital for a little while and their supply of sympathy from outside is cut off by the refusal of visitors, they obtain a desire to get out of hospital again and they seem to be able as a rule to adjust themselves very much better afterwards.

Many patients attending the clinics suffer from organic nervous disorders. An increasing number of patients attend with sequelæ of *encephalitis lethargica*. These patients obtain considerable help from the clinic, because they can be given regular relief to their most distressing symptoms by the administration of hyoscine.

Patients in the early stages of syphilitic nervous disease are best treated at clinics where regular injections of arsenical compounds can be administered and they can often be saved from becoming institutionalized.

Many early cases of organic nervous diseases are detected at the clinic and necessary treatment is given at a stage before serious complications have overtaken the patient. Psychiatry and neurology are inseparable and both must take an important part in the psychiatric clinic.

Quite a number of mentally defective patients are referred to the clinics by parents and school teachers who are in need of advice regarding their management. Unfortunately very little help can be given when special schools and colonies are not available for these unfortunate persons. Nevertheless, the parents can often be given help in managing their defective children and when the home environment is found to be unsuitable, steps can be taken to place these children in more congenial surroundings. It is difficult to tell the parents the real truth regarding their defective offspring, but this duty must be carried out lest the public

be encouraged still to expect hope from expensive but useless endocrine compounds and other patent medicines. Social workers can often assist the parents by giving advice as to methods in which they can employ the mentally backward children and help to solve the difficulties which arise in the daily management of such cases.

Epilepsy is a disease which is very prominent in psychiatric clinics and after a time every clinic collects round it a band of epileptics. It is generally found best to arrange for these people to attend the clinic at a different time to other patients, because their treatment becomes very largely a matter of trial and error and when the most suitable form of treatment has been found for each individual, it has to be continued for a long period of time. "Luminal" has been found to be the most useful drug in the majority of cases, but frequently it has to be combined with bromide and experience with each patient is necessary before deciding on the type of treatment that should be persisted in.

Psychiatric clinics undoubtedly bring benefit to the medical profession and to the general public for they break down the barrier which has so long existed between diseases of the mind and diseases of the body and bring psychiatry within the range of the general practitioner.

Thus by the development of clinics for the treatment of voluntary patients psychiatry and neurology will no longer remain divorced from clinical medicine and surgery, but will be given their proper place in the field of preventive medicine.

THE VOLUNTARY BOARDER SYSTEM IN MENTAL HOSPITALS.

By W. ERNEST JONES, M.R.C.S., L.R.C.P.,
Inspector-General of Insane, Victoria.

THE voluntary boarder clauses in various British *Lunacy Acts* are practically the only concession made by the law in the direction of the early and uncertified treatment of the mentally disordered in mental hospitals and hospitals for the insane.

Preliminary notification proposals deal with the treatment of patients suffering from mental affections outside recognized institutions, whilst the receiving house procedure of the Victorian and other *Lunacy Acts* is not a voluntary procedure, for under it patients requiring observation are compulsorily sent to institutions of this particularly useful type.

Whilst we have to be thankful for this tardy recognition by the law that mental disorders can be treated similarly to physical ailments, the concession really goes but a very little way, for it rarely happens that the mental sufferer has sufficient insight into his condition as to enable him to recognize the necessity for institutional treatment and a voluntary request is the essential feature in the procedure under discussion.

The report of the British Royal Commission on Lunacy and Mental Disorders, presented in 1926, enunciates the following principles:

That the treatment of mental disorder should approximate as nearly to the treatment of physical ailments as is consistent with the special safeguards which are indispensable when the liberty of the subject is infringed; that certificates should be the last resort and not a necessary preliminary to treatment; and that the procedure for certification should be simplified and made uniform for private and rate-aided cases alike and dissociated from the *Poor Law*.

The Commission, however, goes on to express its opinion that the provision in regard to voluntary boarders should be limited to those persons who have volition, and states its view that the voluntary boarder system should apply to persons who are able to appreciate their position and desire to co-operate in their treatment. The Commission believes that there would be less temptation to use this system for patients without true volition if facilities are provided for treating involuntary patients without recourse to full certification. The

proposals of the Royal Commission are, therefore, on the lines of the provisions which have existed in many of the Australasian States for a very considerable period of time, both as to voluntary boarders and the use of receiving or observation houses and wards.

To understand the differences between the British and the Australasian procedure we must have regard to the fact that in England and Wales voluntary patients, since 1890, can be admitted into private licensed houses and registered hospitals, such as St. Andrew's, Northampton, the Holloway Sanatorium; but voluntary boarders are not capable of being received into any of the ordinary county and borough asylums. In Scotland, however, the latter step can be taken but, as a matter of fact, it is not frequently made use of; by far the greater number of voluntary admissions in Scotland is into those institutions which are spoken of as the "Royal chartered institutions," such as "Morningside," "The Royal Crichton," Out of 482 admissions, 218 were in the latter institution.

TABLE A.

Place.	Number of Certified Insane.	Number of Voluntary Admissions.	Number of Discharged Voluntary Patients.	Number of Voluntary Patients. Certified.	Died.	Observations.
England and Wales, 1925	133,883	985	661	213	42	In addition 142 patients in the Maudsley Hospital.
Scotland, 1925	18,431	482	No details	in the Board's	Report.	
Victoria, 1925	6,282	184	147	20	7	
New Zealand, to June, 1925	5,257	172	123	25	9	
New South Wales, to June, 1925	8,265	(a) 343 (b) 150	309 (?)	14 (?)	14 (?)	(a) Psychiatric Clinic, Broughton Hall, mental hospitals. (b) In other hospitals.

TABLE B.—STATISTICAL RETURN OF VOLUNTARY BOARDERS SINCE THE INCEPTION OF THE MOVEMENT IN VICTORIA.

Year.	Admissions.									Discharges			Certified as Insane or Apparently Insane.			Died.		
	State Institutions.			Private Institutions.			Total Admissions.											
	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.	M.	F.	T.
1914 ¹	12	4	16	..	..	1	12	5	17	..	..	..	..	..	..	..	..	..
1915	41	34	75	5	10	15	46	44	90	38	32	70	8	8	16	..	..	..
1916	73	46	119	3	14	17	76	60	136	49	44	93	8	6	14	3	1	4
1917	70	56	126	5	9	14	75	65	140	75	51	126	10	15	25	1	..	1
1918	68	73	141	2	20	22	70	93	163	52	61	113	7	23	30	..	1	1
1919	73	56	129	8	30	38	81	86	167	71	60	131	21	20	41	2	3	5
1920	73	49	122	21	50	71	94	99	193	76	78	154	12	16	28	..	3	3
1921	87	34	121	20	57	77	107	91	198	84	74	158	21	14	35	2	2	4
1922	81	32	113	17	46	63	98	78	176	82	51	133	23	16	39	2	4	6
1923	56	35	91	18	64	82	74	99	173	50	73	123	16	15	31	1	5	6
1924	76	35	111	21	70	91	97	105	202	79	88	167	9	21	30	4	2	6
1925	70	34	104	19	61	80	89	95	184	76	71	147	10	10	20	2	5	7
Totals ..	780	488	1,268	139	432	571	919	920	1,839	732	683	1,415	145	164	309	17	26	43
Percentage of discharges and those certified as insane or apparently insane to the admissions										79.65	74.24	76.94	15.78	17.83	16.80	..	..	..

¹ Three months only.

The subjoined Table A shows to what extent the voluntary boarder system is in use in the old country and in Victoria, New South Wales and New Zealand for the year 1925.

The voluntary boarder clauses of the New Zealand act came into operation in 1912 when twenty-three patients made voluntary application for treatment during the first year. The numbers have risen gradually until in 1925 one hundred and seventy-two patients made similar request.

In Victoria the system came into force towards the end of 1914 and it rapidly became popular. In 1924 no less than two hundred and two patients were admitted at their own request. The subjoined Table B shows the movement of these cases since the voluntary boarder system was recognized in Victoria.

In little over eleven years, 1,839 patients have been admitted and the discharges have amounted to 76.94%. Only 16.80% have required to be certified as insane. When one contrasts these results with the fact that one rarely gets more than a 40% recovery rate in a case of patients admitted to a State hospital for the insane, one must, I think, admit that there is very much to be said in favour of the voluntary procedure.

This is a very simple process, as will be seen by the following application, which is signed by the applicant in the presence of either a Justice of the Peace or a medical practitioner. Following on such an admission, a notice is sent by the medical superintendent of the licensed house or the State hospital for the insane to the head office of the Department and a recommendation is made by the medical superintendent or the visiting medical practitioner of the licensed house to the effect that the applicant should be received for a specific time and under any special conditions which he may think necessary.

APPLICATION TO BE ADMITTED TO A LICENSED HOUSE AS A VOLUNTARY BOARDER.

I (full Christian and surname),
of (full address)
occupation, hereby make application
to be admitted as a voluntary boarder for care and treatment at the house of which is
licensed under Act Victoria No. 2687, Section 105 (hereinafter called the "Licensed House") for a period of

In the event of my wishing to be discharged before the expiration of such period of detention, I understand that I am liable to be detained in the licensed house for three days after an application in writing for such discharge has been received from me by the Superintendent/Visiting Medical Practitioner.

Signature:

I certify that the above-named
signed such request and statement in my presence at
this day of 192
and that he appeared fully to understand the effect of
such request and statement.

Signature

Justice of the Peace
or
Medical Practitioner.

Naturally one asks how many of these patients could have been certified and it would be a very difficult thing to give a satisfactory answer. Seeing,

however, that the best and minority of these voluntary patients are suffering from severe psychoneurotic disorders or from mild forms of simple melancholia and alcoholism who should not be certified, I think we may assume that considerably more than 50% of them are certifiable. Nevertheless, it has very rarely happened with us that patients with well established mental disorder have been admitted as voluntary boarders, although a few patients with general paralysis have come to us in this manner, but they have all been in the early and somewhat doubtful stage.

When one is dealing with private institutions, one has to be very watchful to see that the voluntary request is not abused, as indeed it might be, seeing that the procedure for admission is so extremely simple, but close inspection by a Government medical officer armed with sufficient authority will keep this matter on right lines.

One frequently finds that the objections to certification by relatives refer to the question of the handling of the patient's property. There seems to be current a popular suspicion that directly a person is certified as insane the Master-in-Equity or Lunacy or the Public Trustee empowered immediately impound all their property. This fallacy is responsible for many improper applications for admission under the voluntary boarder clauses. By "improper," I mean that the applicant was manifestly insane and the question of volition and cooperation was somewhat dubious.

The recovery rate of State hospitals and lunatic asylums will show a very considerable reduction as a result of the successful operation of the voluntary boarder system and receiving house procedure and the department which makes a successful use of these methods, will find them a ready explanation for this fact. The recovery rate is at best a fallacious method of judging of the efficiency of such a hospital or department.

With its Psychiatric Clinic at Broughton Hall, New South Wales has taken a very strong lead over other States in Australasia in the early treatment of mental disorders. It must, however, be said that its receiving house system is not run on quite the same lines as is the case in Victoria and South Australia, in which States treatment rather than temporary observation has been made the objective of their reception houses, but the whole movement, by which I mean the use of the receiving house and the voluntary boarder system, is tending in the direction of facilitating the early treatment of mental diseases and disorders and paving the way toward general hospital treatment which must surely be the objective of all those who are working in this difficult branch of medicine.

THE VOLUNTARY PATIENT.

By ST. LEGER H. GRIBBEN, M.D., B.S. (Edinburgh).
Medical Superintendent, Waikeria Reformatory, Kihikihi,
New Zealand.

THE position in regard to the system of voluntary patients or boarders as they are called in New

Zealand might well be considered from the point of view (i) of the patient and (ii) of his friends and the public generally and (iii) of the medical practitioner. In regard to the patient I think the system so far as its practice in this country is concerned may be regarded as eminently successful. It has undoubtedly been the means of bringing to mental hospitals many persons with border line conditions and those in the incipient stages who were formerly debarred from the advantages of early treatment, firstly because they are not readily certifiable, especially on a casual acquaintance and secondly because such patients shrank from the compulsion and the publicity incidental to the ordinary committal. The system under consideration enables them to come to a mental hospital and interview a medical officer without the feeling that they cease to be free agents in so doing. It gets over the prejudice so common in the public mind that mental hospitals are places easy enough to get into, but exceedingly hard to get out of. The patient then comes under treatment under conditions which are the most favourable for recovery, because he places himself under treatment in the early stages and in doing so voluntarily is naturally helping towards his recovery.

The whole outlook in the mental hospital administration of today favours the extension of the voluntary system. The practice of having admission blocks and the extension of the villa system in one form or another brings about a better classification and conduces to housing of patients in smaller, self-contained units where individualization and the existence of the amenities of a home are more easily attainable than under older conditions in which patients were placed in larger general and often congested wards. And this leads to improved facilities for classification and study of the individual. No better tribute to the success of the system even with our present organization which will be largely improved in the near future, could be afforded than the fact that voluntary patients on being discharged frequently ask for assurance that they can come back at any time without formality should they feel the need for further institutional treatment. Here then is developed a clear insight on the part of the patient into his case and a feeling of security that he can return to conditions which experience teaches have benefited him, should he at any time feel that he is again losing a grip of things.

From the point of view of the patient's friends and the public generally, I am convinced that the operation of the voluntary system has been a considerable factor in breaking down the old prejudices against mental hospitals, which prejudices have only too often resulted in an individual's being kept at home until he has become unmanageable or has so deteriorated that his chances of substantial improvement are remote. Here again the absence of the formality and as they feel of the publicity of ordinary committal constitutes an effective incentive in inducing people to bring their afflicted relatives for treatment in the early stages of their trouble.

The voluntary system has unquestionably been a very great aid to the practitioner in furnishing a basis on which he can cooperate with the mental hospital authorities in getting under early treatment without formality those patients who are most likely to be benefited by early treatment under institutional conditions, but cannot be satisfactorily dealt with in their own homes.

As already indicated the voluntary system in its practical working has already proved itself and I am sure that it must be regarded as one of the most important advances in mental hospital administration in recent years.

WEDNESDAY MORNING, FEBRUARY 9, 1927.

COMBINED MEETING.—SECTIONS I, II, VIII, XI.

SPASTIC PARALYSIS.

By S. V. SEWELL, M.D., B.S. (Melbourne),
Honorary Physician, Melbourne Hospital.

IN considering the question of the basis of spasticity, it is necessary to inquire first into the state of our physiological knowledge concerning the mechanism of muscle tone.

Realizing as we do that altering states of the muscles themselves provide the efferent stimuli which are at least largely responsible for the maintenance of muscle tone, we find it necessary to inquire into the destination of these different stimuli within the central nervous system. This means really a brief review of the proprioceptive nervous system.

There are three main pathways of afferent impulses originating in muscles: (i) By fibres passing from the posterior root to the corresponding anterior horn cell and so constituting the first level arc, (ii) fibres passing to Clarke's column of cells and there relaying, secondary neurones passing by way of the direct cerebellar tracts through the inferior cerebellar peduncle to the cortex of the lateral and middle lobes of the cerebellum where another relay takes place. The cortex being largely an afferent relay station, fibres pass from it to the cells of the effector mechanism which were present in the deep cerebellar nuclei, that in the case of the lateral lobe being the *nucleus dentatus*, while in the middle lobe the effector cells are more scattered but are mainly collected into the roof nuclei, *nucleus glabrosus*, *nucleus emboliformis*. The neurones from the dentate nucleus pass by way of the superior cerebellar peduncle to the opposite red nucleus and thalamus and from the latter are indirectly connected by relay with the cerebral cortex and probably the *corpus striatum*. From the lenticular nucleus and red nucleus fibres pass mainly by way of the rubrospinal pre-pyramidal tract which decussates with its fellow of the opposite side high up in the mid-brain, passes through the brain stem, sending its fibres to the anterior horn or final common pathway cells

and so to the muscles by way of the motor nerves, thus completing the great second level tonus and posture maintaining arc.

The effector fibres from the middle lobe mechanism also leaves the cerebellum mainly by way of the superior cerebellar peduncle over which the fibres arch passing down to the upper part of the *pons*, relay in Deiter's nucleus, from which neurones pass upwards to the cranial nerve nuclei by way of the posterior longitudinal bundle and downwards to the anterior horn cells of the spinal cord by way of the vestibulo-spinal tract, thus completing the other more primitive posture maintaining arc. This arc is of greater importance for the trunk musculature, while the later developed and more highly specialized lateral lobe mechanism is more concerned with the maintenance of limb posture so necessary for the upper limb activities once they have been freed from their supporting function with the assumption of the upright position among primates.

Fibres pass by way of the posterior columns up the same side of the spinal cord to the gracile and cuneate nuclei and there relay. Neurones from these nuclei decussating almost immediately pass up in the mesial fillet to the lateral nucleus of the thalamus there again to relay. From the lateral nucleus of the thalamus fibres pass by way of the posterior limb of the internal capsule to the parietal lobule of the cerebral cortex, from which masses of association fibres pass to the other cerebral lobes and largely to the frontal lobe. Ultimately these are connected with the Betz cells of the motor area from which pass the fibres of the pyramidal tract which give off branches to all the final common pathway cells of the brain stem and the spinal cord, thus completing the third or phasic arc of the central nervous system.

Before considering the relative parts played by the different levels in tonus maintenance, it is important to mention the cerebellar-cerebral connexions. Projection fibres pass from the occipital, the temporal and, to a much greater extent, from the frontal lobes by way of the internal capsule and the *crura cerebri* to the pontine nuclei and from these by way of the middle peduncle to the cerebellar cortex, thus completing the cerebellar-cerebral arcs.

When a movement is initiated by the phasic action of the cerebral cortex, the impulse passes from the Betz cells of the motor area by way of the pyramidal tract fibres to the anterior horn cells, fibres of which subserve the muscles concerned in the desired movement. Such a movement, however, would be inefficient for its purpose were it not for the fact that immediately the muscle goes into action, such action stimulates the proprioceptive fibres within the muscle itself, thus causing a stream of afferent impulses to enter the spinal cord by way of the posterior roots. These impulses travel by way of the first and second arcs back to the muscle and thus maintain the tonus and posture which is needed for an orderly carrying out of any movement or for the maintenance of any new fixed posture.

It is probable that the mechanism for carrying out movements of an emotional and protective character are initiated by way of the primitive motor pathway which is indeed the only motor pathway in the bird, that is by way of impulses initiated at the lenticulo-rubral level which pass by fibres of the rubro-spinal or pre-pyramidal tract to the anterior horn cells and so initiate the so-called involuntary emotional and protective movements. Such movements are usually much more widespread in the body and do not show the same selective and localized muscular activities that occur as the result of stimulation from the cerebral cortex. Again the postures so set are maintained by the initiation of streams of stimuli from the muscles themselves, once they are brought into action. It is obvious that these mechanisms are largely independent and it is only necessary to mention the fact that in conditions of hemiplegia in which voluntary movement has become impossible, the paralysed side will go into action as the result of an emotional stimulus, equally with the non-paralysed side. Such a patient will laugh with the paralysed side of his face and will yawn and in the act of yawning the paralysed arm will be stretched and moved as actively as the non-paralysed, so that it is clear that reciprocal action is carried out normally and hypertonus is inhibited from the striate level when such movements are made. It is necessary at this point to consider the results of certain experimental procedures if we are to arrive at any tentative conclusion with regard to the basis of spasticity, but time will permit only of the briefest review. It has been well demonstrated both experimentally on animals and as the result of operation on man that the Betz cell area of the motor cortex can be removed without resulting spasticity in the opposite limbs and the flaccid type of paralysis supervenes. However, in lesions of the internal capsule the resulting paralysis is almost inevitably of a spastic variety. It has been shown experimentally that the spasticity in such cases is due not to the involvement of the pyramidal tracts, but to the simultaneous involvement of the fronto-pontine fibres which pass by way of the anterior limb of the capsule. The stimulation of the cut ends of these fibres either in the capsule or in the *crus* immediately inhibits the spasticity and flaccidity results while the stimulus is maintained, but only if the middle cerebellar peduncle is intact. It is probable, therefore, that whenever a movement is initiated by the phasic action of the Betz cells, a simultaneous stream of impulses passes from the frontal lobes by way of the fronto-pontine fibres and inhibits the action of the tonus maintaining impulses passing by way of the second level arcs, thus facilitating the initiation of movement. Such action is obviously impossible or difficult in internal capsular lesions when these fronto-pontine fibres have been more or less grossly injured. Hence the grave difficulty of carrying out movements even when the pyramidal tract fibres are more or less intact, as is frequently the case when the leg fibres have largely escaped in lesions which are well forward in the internal capsule. It is equally clear that

the fronto-pontine fibres are not the only ones conveying impulses which have an inhibitory action over the second level arcs, since inhibitory impulses are effective in abolishing spasticity when emotional and protective movements are initiated involuntarily at the striate level. Such conditions as *paralysis agitans*, post-encephalitic rigidity and Wilson's disease when the pyramidal mechanism is not involved, are probably instances of disease destroying the inhibitory mechanism of the striate level; although it must be remembered that more complete investigation of cases of Wilson's disease has shown a more or less advanced degeneration in the frontal lobes, thus indicating that further investigation may show that the inhibitory influence of the cerebral cortex exercised at least partly by way of the fronto-pontine fibres is also at fault. In decerebrate rigidity, due to a transverse lesion through the mesencephalon, both of these inhibitory mechanisms are completely out of court and the whole musculature of the body is under the dominion of the proprioceptive tonus mechanism and the reflex standing posture is maintained indefinitely.

It has been suggested that the final common pathway for tonus maintaining impulses is not by way of the anterior horn cells, but by way of the lateral horn cells, through the sympathetic outflow to the musculature by way of the non-medullated fibres.

There seems to be no evidence in favour of such a view, when we are considering lesions at or above the internal capsular level and I have not seen the slightest benefit result from sympathectomy in such cases. It is, however, just possible that tonus maintaining impulses, associated with the maintenance of posture, initiated from the emotional or striate level, may find their final common pathway partly by way of sympathetic outflow to the muscles, thus accounting for the slight improvement reported by different observers in cases of post-encephalitic rigidity when sympathectomy has been performed and for similar improvement in cases of cord lesion, where both mechanisms have been interfered with. The work of Hunter and Royle on the sympathectomized wing of the bird is of great interest in this connexion, since the bird has only a rubro-spinal motor pathway.

It is only fair to point out that there are many instances where proprioceptive afferent stimuli express themselves by way of a sympathetic or autonomic tonus maintaining outflow. Such an instance would be that of the follow-up bladder reflex during micturition. This is maintained by impulses passing to the cord by way of the pudic nerve up through the mid-brain arcs and passing out from the cord by way of the pelvic autonomies to the general bladder musculature, thus enabling the bladder to follow up its content and adopt an ever new posture in accordance with the amount of fluid it contains. That the second level arcs are necessary is clear since in transverse lesions of the spinal cord the follow up reflex is impossible and the bladder always contains a great deal of residual

urine at the end of the act of micturition even though the hypogastric nerves have been severed. In decerebrate conditions, however, the follow-up reflex is intact and the bladder always empties itself at each act.

Examples occur to us readily of the converse condition, in which the affector stream of impulses passes into the central nervous system by way of the sympathetic system and expresses itself in the somatic musculature by a hypertonic condition; such a condition is present in the rigidity associated with an acute appendicitis. These reflexes, however, may be axone reflexes and entirely sympathetic in origin. They are still present in cases of transverse lesions of the spinal cord.

Sherrington was able to produce localized rigidity in the right lower quadrant of the abdominal wall by stimulating subserous nervous structures at the base of the caecum in the neighbourhood of the appendix. I am unable to find the reference, but if my memory serves me right, the reflex was no longer obtained when the spinal motor roots of the lower dorsal segments had been severed. This work would substantiate the older view that the effective pathway for these visceromotor protective reflexes is by way of the myelinated fibres passing to the muscles from the anterior horn cells of the spinal cord.

DR. N. D. ROYLE (Sydney) gave a cinema demonstration on ramisection.

SPASTIC PARALYSIS.

By H. R. G. POATE, M.B., Ch.M. (Sydney), F.R.C.S. (England),

Honorary Surgeon, Royal Prince Alfred Hospital, Sydney.

THE remarks I have to make concerning spastic paralysis will be confined solely to a personal experience of the results of Royle's operation of sympathetic ramisection.

Since the operation was introduced I have had twenty patients under my immediate care, twelve of whom had fifteen operations performed by Dr. Royle at which I assisted and the other eight had fourteen operations performed by myself. In addition I have seen a great number of Dr. Royle's own patients both before and after operation. As a result of such experience I feel moderately competent to discuss the practical value of the procedure.

However, I must first premise that it is very necessary before advising operation to have a complete understanding of what the exact indications are and what is to be expected of the operation. Unless a very definite anticipation of improvement is within view, the operation should not be advised, otherwise discredit will be accorded a most efficacious procedure and disappointment will fall to the lot of the patient. Both lumbar and cervical operations demand a meticulous exactitude of technique for their successful performance and the reported failures to secure any results obviously must be due either to lack of operative dexterity or to ignorance of anatomical detail, perhaps to both.

The actual results of operation must be considered from two points of view: (i) that of the observer and (ii) that of the patient. In most cases these points of view coincide as an obvious physiological result is obtained and the patient experiences a freedom of movement previously unattainable. Occasionally, however, although a definite physiological result has been secured, its practical value to the patient has been hardly appreciable. This is probably due to the influence of other factors beyond one's immediate control, such as the actual pathological changes in the cortex or cortico-spinal pathways, contractures or the patient's deficient mentality preventing a realization of his improvement. In such cases it is not altogether a question of faulty judgement in the original selection, but is one of inability to determine with any certainty the part such factors may play in the final result, until the abnormal postural tonus has been abolished by the operation. Unfortunately a number of patients suitable otherwise for operation have such a limited intelligence that their cooperation in after treatment cannot be assured and it is very questionable whether operation should be advised for them excepting in the case of very young children where there are potentialities of growth and development.

The results obtained in the inferior extremity seem better from the practical point of view than in the superior extremity, probably because the lumbar operation is a more certain and direct method of attack and also because the lower limb is not concerned with such fine movements in its function as is the upper limb.

In the twenty-nine operations with which I was concerned, the results may be classed as follows:

TABLE I.—RESULTS OF OPERATIONS.

Nature of Result.	From the Patient's Point of View.	From a Physiological Point of View.
Good	14	20
Fair	8	5
Poor	3	4
None	4	0

It is particularly worthy of notice in view of recent criticism that in no case was there a failure to obtain a definite physiological result. There is no doubt about this whatsoever and it can be demonstrated before the patient leaves the operating theatre.

As soon as consciousness is restored the patient senses a difference, a new and strange freedom of movement is always commented on and voluntary control is thereby improved. This is chiefly brought about by a newly acquired ability to relax the previously spastic muscles. This also results in a speeding up of voluntary movement. With re-education the range of voluntary control as well as power increases for some weeks or months.

In patients whose lower limbs have been affected, the most noticeable general feature after operation is the restoration of balance. These patients frequently remark on the amelioration of obstinate

constipation which has ensued as a result of operation; there is also relief from the annoyance of chilblains.

I have observed in cases where more than one limb is involved, that after operation on one there is some improvement in function of the other not operated on. This probably is due to a diminution of the conscious effort at cortical control necessary prior to operation as well as to a depression of reflex hyper-excitability.

In my experience the best results have been obtained in cases of spasticity following cortical injury, but occasionally one meets with general increase of postural tonus in one or more limbs consequent to encephalitis. These give excellent results which are permanent as compared to the temporary relief given by hyoscine. Unfortunately, however, so many post-encephalitic patients have such a defective mentality that operation is inadvisable.

My experience has been limited to adults who can usually cooperate in after treatment and have an earnest desire to improve their condition. In children, particularly when mental deficiency is a feature, the final functional results seem to be longer in arriving and to be dependent on the subsequent neuro-muscular adaptability of the patient.

As far as the operations are concerned there is no shock and the patient is anxious to get out of bed very early. I have experienced no unpleasant after effects nor complications as a direct result of the operation.

In conclusion I would remark that from the results obtained I consider the operation one of great value in the treatment of carefully selected cases in conjunction with the usual orthopaedic practice for correcting deformities.

In the cases under notice I would point out that in 50% the result to the patient could be classed as good and in 27% as fair or as they put it "well worth while"; that is 77% have been given definite relief from an otherwise hopeless infirmity. In the four cases classed as failures from the point of view of practical benefit to the patient, the original lesion was in the lower thoracic region of the spinal medulla which is anatomically an unfavourable site on account of the pathological block to cortical control.

SPASTIC PARALYSIS.

By T. W. LIPSCOMB, M.B., Ch.M. (Sydney).
Honorary Surgeon, Lewisham Hospital, Sydney.

In common with other speakers I would like to congratulate Royle on his research work on the sympathetic nervous system and the important bearing it has on the relief of conditions, which formerly were very difficult to deal with and especially spastic paralysis.

Unfortunately many of the sufferers from this disease are severely handicapped mentally and in addition there are subsidiary effects, such as contractures and although the operation of ramisection produces in every case definite physiological results

ILLUSTRATIONS TO THE ARTICLE BY DR. HERBERT H. SCHLINK.



FIGURE XIII.
Sketch of low power section of cervix. Ring encloses group of diplococci in connective tissue far removed from lumen of the glands.



FIGURE XIV.
Sketch of lower power view of section through cervix. Ring encloses lumen of gland and a group of diplococci buried in the connective tissue far removed from basement membrane.



FIGURE XV.
Microphotograph high power, showing glands and organisms in connective tissue. Ring marks site.

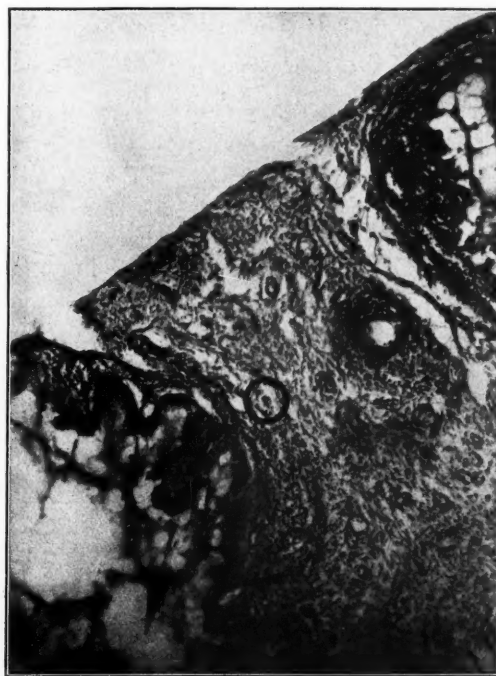


FIGURE XVI.
Microphotograph high power, showing glands and organisms in connective tissue. Ring marks site.

ILLUSTRATIONS TO THE ARTICLE BY DR. HERBERT H. SCHLINK.



FIGURE XVII.
Microphotograph high power, showing glands and organisms in connective tissue. Ring marks site.



FIGURE XIX.
Microphotograph of microorganisms in connective tissue of cervix. (High power oil immersion view). Ring marked in sketch.

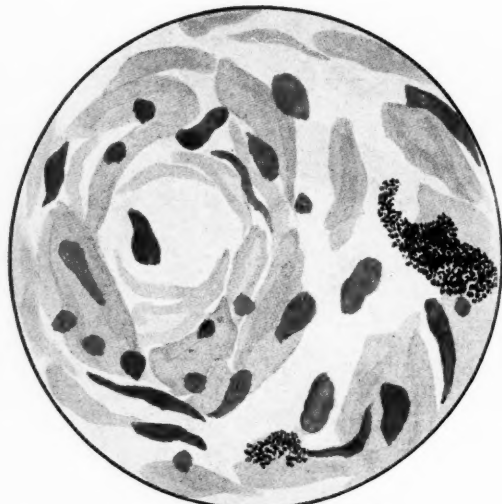


FIGURE XVIII.
Sketch of cervical tissue (high power oil immersion) showing a racemose gland and diplococci which have penetrated the basement membrane and are lodged deep in the subepithelial connective tissue area marked by ring in diagram.

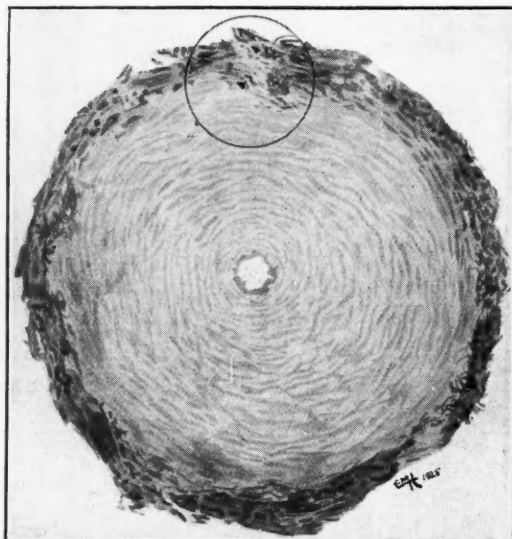


FIGURE XX.
Sketch of uterine end of tube (low power); ring encloses diplococci in subperitoneal layer, no inflammatory change can be detected in the mucosa of tube and muscularis.

ILLUSTRATIONS TO THE ARTICLE BY DR. HERBERT H. SCHLINK.

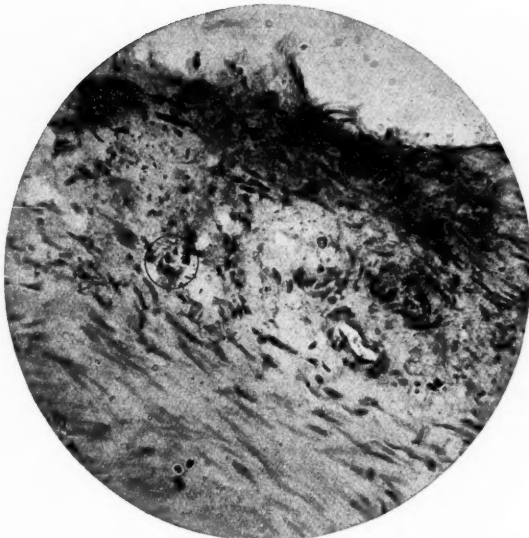


FIGURE XXI.
Microphotograph of subperitoneal layer of cornual end of tube. Ring shows position of diplococci.

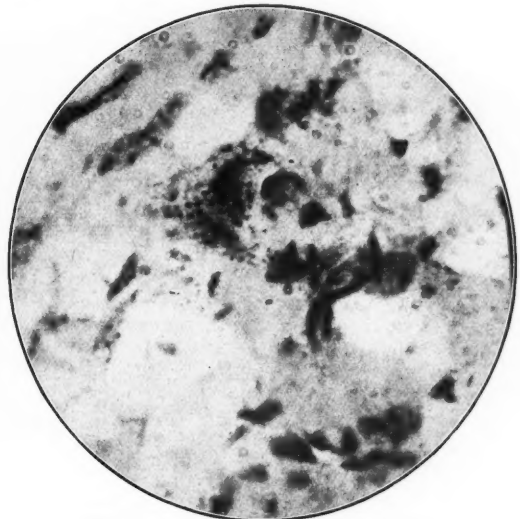


FIGURE XXII.
Diplococci in subperitoneal connective tissue. High power oil immersion view of area marked by ring in Diagram VII.

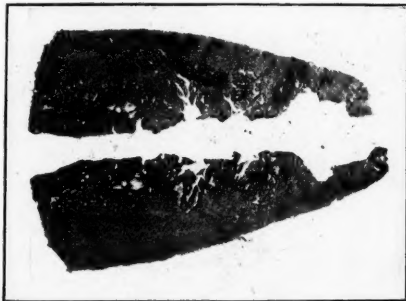


FIGURE XXIII.
Longitudinal and cross sections of the endocervix removed by the enucleator.

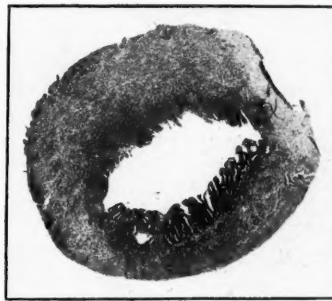


FIGURE XXIV.



FIGURE XXVII.
Endocervix two years after enucleation. Section low power showing cervical canal lined by stratified epithelium and no glands. Racemose glands and columnar epithelium were removed by enucleation two years previously. Rings indicate where microphotographs under high power have been taken. The end where two rings are close together indicates region of os externum. (Microphotographs by Dr. E. Morris Humphrey.)



FIGURE XXV.
Cervix after enucleation has been performed.



FIGURE XXVI.

ILLUSTRATIONS TO THE ARTICLE BY DR. HERBERT H. SCHLINK.



FIGURE XXVIII.
Endocervix enucleated two years ago. Microscopical sections show the following features traced from the cervical canal surface to deeper structures. (1) Squamous epithelium which has completely covered the original raw surface. This epithelium is quite normal and shows no hyperplasia. (2) Fibrous tissue in which there has developed very numerous small blood vessels. No glandular acini could be seen. (3) Fibro-muscular tissue in which can be seen well developed blood vessels. (L. Utz.)



FIGURE XXX.
Enucleation two years afterwards. Microphotograph high power of stratified epithelium in region of external os, ring 3. (Microphotograph by Dr. E. Morris Humphery.)

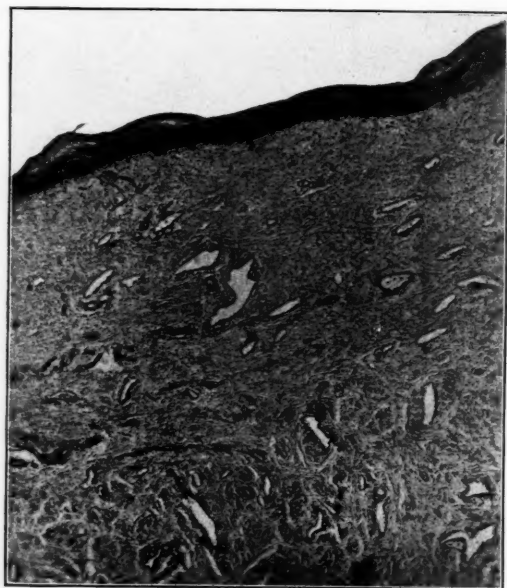


FIGURE XXIX.
Enucleation two years afterwards. Microphotograph of Ring 1 half-way up cervical canal. Note stratified epithelium and no glands, also that it is thinner than that of portio vaginalis. (Microphotograph by Dr. E. Morris Humphery.)

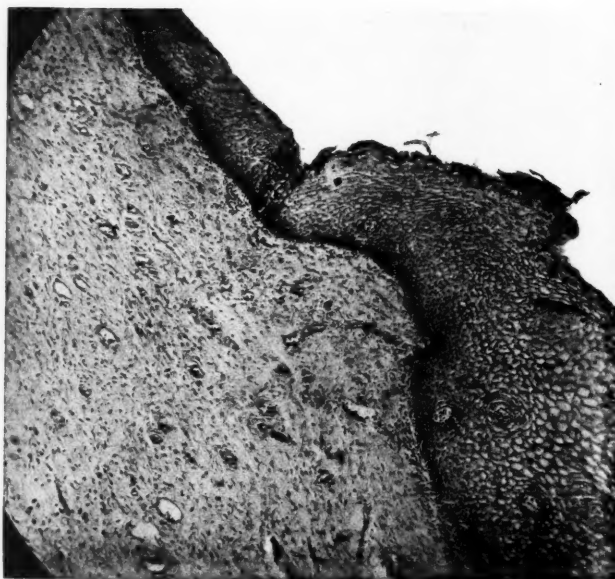


FIGURE XXXI.
Microphotograph high power ring 3 showing stratified epithelium of cervical canal as it merges into the thicker stratified epithelium of the portio vaginalis. (Microphotograph by Dr. E. Morris Humphery.)

and contractures can be dealt with on appropriate lines, yet in many instances owing to the mental handicap, the results to the public life are not so apparent.

Those of us who work at Lewisham Hospital in Sydney and who have seen the evolution of this work on the sympathetic and its practical results, are absolutely satisfied with its benefit and that ramisection will become a recognized standardized procedure for certain definite conditions.

The effect of the sympathetic or autonomic nervous system on muscle tone has been well demonstrated at this Congress, as also has the effect of sympathetic surgery on bowel musculature as shown by Dr. Wade in his report of Hirschsprung's disease.

Professor John Fraser, of Edinburgh, in an interesting lecture⁽¹⁾ at St. Bartholomew's Hospital in November, 1925, correlates the effect of the sympathetic in the alimentary canal more particularly in the region of sphincters and refers to the upsetting of the balance between the sympathetic and parasympathetic in the causation of congenital hypertrophic stenosis of the pylorus, Hirschsprung's disease and in intussusception.

I have no doubt that what Keith calls the gastrointestinal nodes have great relation to this want of balance and that further researches on the sympathetic in the light of the work done in Australia will clarify our conception of the pathology and aetiology of various conditions in regard to which we have been groping in the dark.

Reference.

⁽¹⁾ J. Fraser: "The Surgical Aspects of Certain Disturbances of the Involuntary Nervous System Met With in the Alimentary Tract," *The British Medical Journal*, February 27, 1926, page 359.

Dr. E. D. PULLEN (Christchurch) briefly recounted their experience in Christchurch with the operation of ramisection. In suitable cases they had had good results. It was essential to operate only in suitable cases.

HISTOLOGICAL EVIDENCE ON THE PRESENCE OF SYMPATHETIC NERVE ENDINGS IN STRIATED MUSCLE FIBRES.

By OLIVER LATHAM, M.B. (Sydney).

Pathologist, Mental Hospitals Laboratories, New South Wales.

WHEN your Secretary asked me to speak a few words on the histological aspect of the subject of spastic paralysis, I presumed that he referred to the idea of sympathetic nerve endings in striated muscle. This subject has been taken up by so many workers with opposing views that I would have felt diffident about opening the discussion were it not that I feel you will give me credit for desiring above all scientific truth opposed as this may be to the results of some little work I have been associated with. And it has been my good fortune to have access to an unpublished paper bearing on this very matter of my

colleague, Dr. Wilkinson, who believes that he has evidence which criticizes some of our findings.

Doubtless your Secretary believes with Davis and Kanavel:⁽¹⁾ "that the definite establishment of the fact that skeletal muscle has a sympathetic innervation underlies the entire problem of the relation of the sympathetic system to increased tone of the muscles of the extremity. Further, if we grant such a supply is present, we must know absolutely that such an innervation initiates, maintains or in some way influences muscle tone."

The Origin of Our Inspiration.

I think we can say that the recent histological approach to this subject as far as our school is concerned began when the late Professor Kulchitsky,⁽²⁾ working in Professor Elliot Smith's laboratory in University College Medical School, showed the late Professor Hunter some of his gold impregnation specimens of the striped muscle of python wherein he demonstrated two types of nerve endings, the coarse, hypolemmal motor plates from the myelinated motor nerves and called "*terminaisons en plaque*" and much more delicate grape-like endings which he traced from nucleated, unmyelinated nerve plexuses from mixed nerves and which he considered "*terminaisons en grappes*" belonging to the sympathetic system. He believed that the latter were epilemmal. Professor Kulchitsky published his findings in a paper in which he maintained that he believed he could distinguish thicker and thinner striated muscle fibres and that the *plaque* endings were associated with the thick fibres and the *grappe* endings with the thin ones. Also that he never met with both these types of endings on the same muscle fibre. He traced some of these fine presumably sympathetic fibres on to capillaries and the muscle spindles. He ended his paper with an excellent bibliography.

Earlier Workers on Nerve Endings in Striped Muscle.

One of the earliest workers was Tchiriew (1879), who described and named these two terminations, but believed that the *grappe* form was hypolemmal and recognizing many intermediate forms held that the *grappe* forms were young, immature endings which would develop into the common motor *plaque* forms of myelinated nerves. He also believed that he saw *grappe* endings come off "finely medullated" nerves, findings of interest later on in this paper.

Bremer (1882) agreed with most of this and found some non-medullated fibres connected with finely medullated ones. However, he seemed emphatic that the one type did not grow into the other and believed that the *grappe* terminations were sensory. Perroncito thought the *grappe* endings might be epilemmal or hypolemmal and have primitive sole plates.

More modern is the work of Agduhr, Dusser de Barenne and especially Boeke, who using the silver method of Bielschowsky, describes accessory nerve endings as always occurring near the motor ending of the motor myelinated nerve. He is satisfied that this accessory ending is sympathetic, as he has traced their connexion with vascular sympathetic

plexuses, but other authors and workers quoted in this paper make a particular distinction between Boeke's accessory endings and the so-called *grappe* endings.

Some Points Under Discussion.

Another point which must be stressed here is that some of these workers assumed that the sympathetic fibres come from plexuses around lymphatics and blood vessels and others find them in cross sections of the motor nerves to the muscles. This will be further analysed later on.

We must also bear in mind the idea that some myelinated nerve fibres may give forth while yet composing a relatively large nerve, a very long collateral or several of them. We have all met with short ones ending with both types of endings and these collaterals are of course unmyelinated and look like sympathetic nerves, save that they come off a myelinated nerve at a node of Ranvier. We join issue with those who have seen strands of exceedingly fine nerves proceeding far up these motor nerves, so that if they are collaterals, they must come off very far up these nerves. These are the fibrils which form plexuses sending some of the *grappe*-like endings to the muscle fibres.

Results of Our Own Work.

In the work of the late John I. Hunter and myself we believed that we could show in the wing muscle of the hen these two types of endings, but that in the bird the two forms differed more in coarseness rather than in type. In one instance in the plexus of fibres supplying *grappe*-like endings to the wing striped muscle the gold impregnation partially failed leaving the nerve fibres partially transparent. Here could readily be seen nuclei of the neurilemma closely applied to the axis cylinder. Botezat had reached the same conclusions in 1906 in his work on birds. We found the gold impregnation method most capricious and in our first work failed to get good reptilian material. Using the goat, however, we got these so-called grape-like endings in the extrinsic eye muscles and traced them to plexuses, but could not find out whence these plexuses came, which did not appear to have nodes and in which one found branching and apparently anastomosing fibres. We believed that some of these endings, the most delicate ones, were epilemmal, while some of the larger ones sometimes attached to thicker stalks appeared to have associated with them some condensation of tissue, possibly sole plates. These might have been hypolemmal, but we could not be sure. It was here that we noted the occurrence of unmyelinated collaterals coming off motor nerves at their nodes and having different types of endings. We were not able to find muscle fibres having on them both motor endings *en plaque* and the so-called *en grappe*. Differences in both the calibre and colour of the different muscle fibres were noted, but no connexion whatever could be traced between this and the type of nerve ending; in fact we could not be certain whether this were not an artefact, considering how the formic acid and glycerine had macerated and

swelled up the tissues which furthermore had also been subjected to different pressures in the mounting. Personally I also examined paraffin sections of pathological muscle, but here again could not reach any decision with regard to differences of fibre calibre and the presence of any sclerosis. This year, however, I obtained some tissues of a large blue-tongued lizard and both Dr. Wilkinson and I got some excellent gold impregnation. It soon appeared evident that one could not make hard and fast divisions into *grappe* and *plaque* terminations and I made temporarily the following classes: (i) The common motor *plaque* endings from obvious myelinated fibres, (ii) a more delicate ending but morphologically like the latter, with a condensation of tissue resembling a sole plate. This ending came off a fibre which seemed in between a myelinated and a non-myelinated fibre and sometimes seemed accompanied by one very fine fibre, but generally remained small. This fibre Dr. Wilkinson has since shown me as finely myelinated and coming off a node of a myelinated fibre. (iii) A typical *grappe* ending always coming from a plexus of two at least but much more often many more extremely fine, pale fibres forming plexuses, whose proximal parts could under favourable circumstances be traced far up the mixed nerves, which often after ending on one fibre proceeded to form similar endings on many more muscle fibres, the fibres passing through the ending. (iv) A minute frond-like single ending as a rule proceeding from just one extremely fine fibril, which sometimes on further examination resolved itself into two fibrils coming directly out from a bundle of nerve fibres and which were often hidden therein by the metallic deposit. This fibril often passed over many muscle fibres to reach its destination and at least was attached to the sarcolemma. Now type (iii) is the one almost exclusively depicted by Kulchitsky in both photographs and diagrams and the recognition of the other two somewhat non-plussed me. Sometimes all these types could be found in association with one main nerve tree and sometimes nerves seemed to be associated entirely with say type (i) and at the other end of the section with say type (iii). Even so, I could not make out readily any muscle fibre with both types of endings, but then I never managed to mount an entire length of a striped muscle fibre. Many muscle spindles also were visible and sometimes the grape-like endings appeared to be a branch of a myelinated nerve and sometimes these separate delicate endings could be traced to those plexuses of very fine nerves coming from the mixed nerve.

Other Opinions Held.

Professor Hunter in a separate paper believed he could trace different sizes in the cross section of muscle whose sympathetic supply had been cut, as well as some slight excess of sclerosis. Obviously much experimental work remains to be done to see what fibres and endings would and would not degenerate on section of these respective systems. Much has been done, but the results are contrary and not quite conclusive. Tozer and Sherrington⁽³⁾ showed that the third cranial nerve contained both

sensory and motor neurones and that the extrinsic muscles of the eye contained besides hypolemmal motor endings an abundance of these grape-like endings especially near the tendon of insertion and that all these as well as the motor plates degenerated when the third nerve was cut near the brain stem. From this they supposed that the grape-like endings were sensory. Others found that these latter endings did not degenerate for thirteen to fifteen days afterwards, while the rest did in five. On the other hand Kuntz and Kerper⁽⁴⁾ found these grape-like endings intact after the intervertebrals had time to degenerate. Hinsey in an unpublished paper quoted by Ranson states that after section and degeneration of all the sympathetic system many of these small endings remain.

Woollard⁽⁵⁾ using the methylene blue technique could not find the grape-like endings in ordinary striated muscles, but did so in the extrinsic eye muscles, at least in the connective tissue between the muscle fibres he found such a forest of these endings associated with non-myelinated fibres that they must represent most of the nerves going to these muscles. Finally Garven⁽⁶⁾ satisfies himself that nerves to muscles contain innumerable fine non-medullated presumably sympathetic fibres which give endings to muscle fibres and in association with some of these fibres and endings, branches jump off to end on capillaries. Thus, he defines two systems of sympathetics, one with the nerves to the muscles and the other with the vascular system. He cannot say whether these are for sensation, tone or nutrition or to provide another sympathetic route to the capillaries and this probably represents the majority opinion to-day regarding the dual innervation of voluntary muscle. He also shows clearly that one striped muscle fibre may have both types of nerve endings thereon.

Mention might be made here of the tendency to implicate the sympathetic system in the dystrophies, as for instance by Bramwell.

Some Unpublished Work on Nerve Endings.

In this state of affairs Dr. J. K. Wilkinson,⁽⁷⁾ Lecturer in Anatomy in our University, set himself to check these findings in view of their want of agreement. He used the frog, lizard, echidna, bandicoot, horse, rabbit, mouse, cat and man. The techniques employed were the *intra vitam* methylene blue method of Ehrlich (quoted by Wilson) and the gold chloride method of Ranvier modified by Garven. The tissue after treatment by methylene blue was fixed in ammonium molybdate (saturated) to which had been added some osmic acid, a method which shows the axis cylinders blue and the myelin smoky. This showed that *terminaisons en grappe* came off medullated nerves and he noted the intermediate varieties of endings. He goes on to say that only in amphibia and reptilia are there motor endings of the grape-like type; recent investigators had confused these with Boeke's accessory endings. Looking up Tozer and Sherrington's article he believed he recognized as endings of a sensory nature those *terminaisons en grappes* detailed in the extrinsic eye muscles of goats by recent investigators and

also believed in the old theory with Tchiriew that in certain animals and reptilia grape-like endings were stages in the life history of a common motor plate. His findings may be summarized thus:

1. Every striated muscle fibre is innervated by a somatic nerve.

2. Possibly every striated muscle fibre receives a sympathetic innervation in or near the sole plate in which the somatic nerve ends.

3. *Terminaisons en grappes* as described in amphibian and reptilian muscle and in the extrinsic muscle of mammals are in no way to be confused with the sympathetic accessory endings of Boeke.

4. In amphibia and reptilia at least some of the grape terminations are developmental or immature forms of ordinary somatic motor endings and some may be sensory and resemble those which occur elsewhere in tendon spindles, muscle spindles, peritomeum and so forth.

5. Grape-like terminations in the extrinsic eye muscles of mammals are terminations of sensory nerves.

6. Boeke's sympathetic endings may belong to fibres derived from the plexus around blood vessels or lymphatics.

7. Finally as regards muscle spindles my observations confirm those of Perroncito, namely that they receive somatic, sensory and motor nerves and also fine nerves probably sympathetic in origin.

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COMBINED MEETINGS.—ALL SECTIONS.

CANCER: THE PRESENT POSITION.

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THE last few years have been marked by a lively public interest in the cancer problem, an interest which is in the main an evidence of the magnitude

of the effort that is being made to solve it. It is an effort on a scale that has never before been attempted in attacking any one medical problem. The great British Empire Cancer Campaign naturally holds pride of place in our minds, but there are no political frontiers in this war and all civilized nations are with one accord giving of their best to combat the common enemy.

It is not unnatural that some result should be expected, somewhat breathlessly perhaps, from such a concerted attack. Results there have been, many and important, significant generally as well as in relation to the cancer problem. For some of these results extravagant claims have been made, which in an ephemeral review like the present will cause them to assume a spurious prominence, the more marked because it is impossible even to notice a tithe of the work which has contributed materially to the present state of our knowledge.

Statistical records of the causes of death in civilized communities have forced upon our attention the increasing importance of cancer in such records. A steadily increasing rate is characteristic of all countries in which reliable records are available. The statistical weapon, even in the hands of the trained biometrician, is a dangerous one. This is not because it is not a good weapon. If its use were better realized, there would be fewer wild statements in medical literature. But particularly in such statistical studies data are often absent, insufficient, vitiated, wrongly applied or omitted and results suffer in consequence. Even so simple a fact as the increase of cancer as a cause of death in the records is in the latest competent analysis held to be sufficiently explained by better diagnosis and the survival of more people to the cancer age. This is, of course, not a new thought, but it emphasizes the fact that we cannot speak with confidence of the spread of cancer.

By statistical methods different workers have in recent years claimed to establish correlation between cancer and diabetes, cancer and salt consumption, cancer and the decline of tuberculosis as a cause of death. It is difficult to assess the value of such correlations. No doubt the most absurd relationships could be equally soundly established. That with diabetes, an American study, unassailable mathematically, has been proved not to be generally applicable. That with the decline of tuberculosis as a cause of death has led to an experimental investigation of a possible causal relationship with the *Bacillus tuberculosis* by Cherry, of Melbourne.

It is, however, a curious fact, brought to light by recent analyses, that though the steady increase is true of the cancer group, it is not true of individual cancer types, some of which show an actual decline, while the increase in different types is at different rates.

Animal experiment continues to be a prolific source of information concerning tumour growth. The mere detailed enumeration of the directions in which inquiry is pursued by this means, would consume more time than I can devote to it. It has led us to a knowledge of a variety of methods of producing tumour growth, of the susceptibilities

and resistances of animals to tumour transplantation and of means of modifying these, of the effect of metallic salts, radiation, vitamins, tissue extracts on tumour growths, of the relationship of heredity to tumour growth.

The outstanding work on heredity in relation to cancer is that of Miss Slye with her long generations of mice. She holds the view, in spite of outside evidence to the contrary, that cancer is dependent on truly inherited characters. Thus liability to develop cancer spontaneously is recessive. Liability to successful "taking" of cancer grafts is dominant. Both behave in simple accordance with Mendelian expectation. There are results by other workers which conflict with this view, but the scale on which her work is conducted, while limiting the possibility of ready confirmation or challenge, compels attention to this interesting conclusion.

Of all the recent announcements on the subject of cancer that of Gye has achieved the greatest publicity and the advocates of the extrinsic bacteriological theory have lifted up their heads at this possible vindication of their views. It is too early to pass final judgement. Nevertheless, there is not lacking serious criticism of the evidence by which his analysis of the factors involved in the production of a Rous sarcoma into a filter-passing virus and a chemical factor must stand or fall. Murphy, who has done much work with this tumour, does not even admit that the filter-passing agent is an ultra-microscopic virus at all and shows that "cultures" of embryonic tissue or placenta can activate chloroformed filtrate. The evidence that antiseptics in Gye's experiments have actually killed the virus is doubted by other experimenters, while Harde claims that activation can be accomplished by insuring an acid reaction. The proof of the presence of the virus in other tumours is thus in doubt. The Rous sarcoma is admittedly peculiar. Gye claims that his experiments bring it into line and that he has demonstrated the cause of new growths. The inference that there is one cause of new growth is mere assumption. That the filtrable agent of the Rous sarcoma is that cause awaits demonstration.

No line of investigation is yielding results of greater importance to our understanding of the problem of tumour growth than that of methods adapted to the study of the conditions of life and growth of cells, notably tissue culture. Warburg is responsible for a most striking research into the metabolic processes of cells, in particular the abnormal metabolism of the cancer cell under aerobic and anaerobic conditions. He showed that glycolysis is important as a source of energy for the cancer cell, much lactic acid being produced in the process, and that it is correspondingly independent of oxygen consumption and tolerant of anaerobic conditions, that it behaves in fact qualitatively like an asphyxiated normal cell.

Notable also is the work of Heaton who has distinguished factors affecting the multiplication of fibroblasts and epithelia respectively, the factor pro-

moting epithelial growth being apparently identical with vitamin B, while all tissues contain a substance inhibitory to fibroblastic growth. The importance of these observations in inflammatory conditions and in tumour growth is obvious. Many other workers, Carrel, Drew, Burrows, Jorstad, have contributed observations on growth promoting and inhibiting factors, prominent among the former being products of cellular autolysis, while Drew, Carrel, Strangeways and many others are adding continually to our knowledge of cellular differentiation and thus of the meaning of the appearances seen in normal and abnormal tissues. From this field, too, comes the significant observation of the action of X rays in modifying cells, so that they breed true in abnormal forms, recalling those observed in new growths.

It is scarcely remarkable that efforts directed particularly to treatment should attract special attention. In this field prominence must be given to three methods of attack: Blair Bell's lead treatment, Lumsden's immunological work and radiological investigations.

Drawing a parallel between chorionic epithelium and malignant tissue in respect to morphology, physico-chemical characters and metabolism and arguing that their toxicological affinities are similar, Blair Bell has applied treatment with a colloidal form of lead, with apparent success in a limited number of patients suffering from cancer. Whatever may come of the method (and it is still in process of development), his ideas have stimulated a vast amount of research in the Liverpool Cancer Research Organization.

Numerous observations on immunity and susceptibility have been made in the course of animal experiments on cancer by Bashford, Murray, Cramer, Lynch and others. Lumsden, however, working with mouse carcinoma and rat sarcoma has succeeded in producing antisera which kill the corresponding cells *in vitro* and are much less toxic to normal tissues than to malignant cells. Injection of an appropriate serum into a rat sarcoma combined with the induction of temporary stasis, has led to the disappearance of the tumour and the production of an immunity against reinoculation. One hesitates to give expression to the hopes that confirmation of such an observation would raise if the principle should prove applicable to human beings.

There is no question but that the work of radiologists on the treatment of new growths has established the efficacy of the method especially in the case of certain lymphatic and epithelial tumours. We are witnessing the gradual replacement of empiricism with knowledge, both clinically through histological control and experimentally by the determination of dosage and the analysis of the forms of radiation in use particularly in regard to variation of activity with wave length. The examination of the fundamental nature of the action of different forms of radiation on cellular activity cannot but be fruitful.

The search for a general clinical test that will prove of value in the diagnosis of cancer has as yet gone comparatively unrewarded. Botelho's

serum reaction among the many shows more correspondence with the presence of cancer than any of the others to judge by reports. Unfortunately the percentage of failures is much greater in doubtful cases where it would be of value, than in those in which there is no clinical uncertainty. Fry has evolved a flocculation test, using breast cancer tissue extract as the antigen, and claims a good correlation with the presence of cancer. Electrophoresis, an eosin test, osmotic resistance and sedimentation rate of red blood corpuscles, surface tension of serum and numerous other determinations have been tried. None as yet has established any dependable value as a clinical aid.

Sound histology is essential to the progress of cancer research. Its direct clinical associations, especially with surgery, but also with experimental pathology, medicine and radiology have raised the standard of critical opinion and subjected old views to much revision as the perusal of any current journal will show. Its value in the study of the natural history of classified tumour types to the practitioner and the academic investigator is becoming daily better appreciated.

Its value is perhaps more obvious, not so much in relation to the main cancer problem awaiting solution, as in the more immediately practical question for the community, the reduction of mortality from this disease by methods already to hand. Here time is of the utmost importance, that our available weapons may have some chance, since the essence of success is early diagnosis and treatment. It is, therefore, a necessity that there should be cooperation between the medical practitioner and the public and for that cooperation to be possible and effective, the dissemination of knowledge of early symptoms is imperative. Missionary work of this kind has been begun in many places and should be increasingly successful as the profession and the public become more alive to its importance.

It is scarcely possible to draw any useful conclusion from the heterogeneous mass of facts available. We know a great deal about cancer and presently we shall know a great deal more. Much of it is enveloped in a mist of theory which will only be dispersed by the sun of understanding. It may be that one of the shorter routes may lead to an empirical and probably a partial solution of the problem of treatment. Lumsden's work is the most encouraging in this respect. *Ætiologically* those who seek a specific bacterial cause, would appear still to have an open field. There is nothing as yet to make us shift from the belief that it is to the cell we must look for the explanation of its behaviour, since the cause that lacks that explanation is incomplete, be it intrinsic or extrinsic. That the problem will be solved there is little doubt. Fostered, perhaps, by injudicious announcements, there is a general air of expectancy abroad that it will be soon. To this we add a fervent hope.

PROFESSOR C. E. HERCUS (Dunedin) read a paper by DR. N. E. H. FULTON (Dunedin) who had been engaged in an investigation into the incidence of cancer and the effects of radium therapy.

Dr. WI-REPA (Gisborne) referred to the Registrar-General's statistics which indicated that cancer was rare among the Maoris. In his experience cancer was common. Certification of death among the Maoris was not always made by medical men. In the old days the Maoris were such a warlike people that probably very few of the men reached the cancer age.

Dr. L. E. BARNETT (Dunedin) was struck by the prevalence of cancer in the alimentary canal. Deaths from stomach cancer exceeded deaths from cancer anywhere else in the body. Of recent years there had been an improvement in the mortality from buccal, breast and uterine cancer. There might be some relationship between diet and the temperature of food and stomach cancer.

Dr. A. NORMAN MCARTHUR (Melbourne) referred especially to uterine cancer. He wished to appeal for early diagnosis. Every extraneous discharge should be immediately investigated and cancer proved or disproved. Early cancer of the uterus could be cured by surgery and radiology.

Dr. P. D. CAMERON (Wellington) advocated that every case of cancer should be seen by a group of medical practitioners, surgeon, physician, gynaecologist and radiologist. Such a practice would materially help the radiologist. In his opinion deep therapy was successful in a considerable number of patients.

Dr. T. MACGIBBON (Dunedin) said that it was too early to say that food was a cause of gastric cancer. The standard of food in New Zealand was very high. In England the increased incidence of cancer in the abdomen was accompanied by a decrease in deaths from vague abdominal causes, due to improved diagnosis.

SECTION III.—OBSTETRICS AND GYNÆCOLOGY.

PELVIC LYMPHANGITIS

OR

THE RÔLE OF THE LYMPHATICS IN PELVIC INFLAMMATION.

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PREAMBLE.

I DEEPLY appreciate the honour which the Section of Gynaecology and Obstetrics has conferred upon me by the invitation to deliver an address at Congress and I trust that the remarks I am about to make will serve to throw some new light on the diverse and complex subject of inflammation affecting the internal genital organs of the female.

My address, based upon certain pathological findings in tissues removed at operation, will endeavour to show the great importance of the lymphatic system as a path of spread in certain classes of inflammatory lesions in the female pelvis and I trust you will not be too severe in your criticism of the deficiencies of this preliminary announcement of my studies on this subject.

Although the importance of the lymphatics has been recognized in the inflammatory reactions which arise from septic infections in almost every region of the body, it must, nevertheless, be admitted that in this respect scant attention has been bestowed upon that vast and prolific system of lymphatic channels which enclose the uterus and its adnexa. A system which in the opinion of some gynaecologists is mainly responsible for the distribution of the ascending infections of the pelvis. I shall endeavour to bring forward evidence in support of this view. I fear that the

neglect of this important avenue of invasion has been due to the old anatomical text books in which has been stressed the point that the female is peculiar in having a genital tract running from the surface of the body and opening directly into the peritoneal cavity and that on account of this peculiarity she is more prone than the male to pelvic peritonitis. It was only natural that the gynaecologists of former times should allow this anatomical fact, which presents an apparently easy and direct method of invasion for infective organisms, to obscure the more indirect and intricate lymphatic path of spread.

To-day I propose to show actual and irrefutable evidence of this mode of lymphatic spread, but before developing the subject further, I might be permitted to recall to your minds the anatomical distribution of the lymphatic system of the pelvic organs of the female.

Lymphatics of the Female Pelvis.

In this necessarily brief description of the lymphatics of the internal genital organs of the female I have drawn freely from Poirier and Charpy's "The Lymphatics" (1903), Quain's "Anatomy" (1912) and Leopold's work whose half century old description of the uterine lymphatic circulation stands unchallenged to this day. Without going into their various subdivisions, I might first recall to mind the glandular groups into which the lymphatic tributaries of the internal genital organs drain. Speaking generally, the lymphatic glands under review are disposed fairly regularly round the blood vessels and this paravascular arrangement enables us to divide them into four large groups:

- (i.) The hypogastric glands scattered along the front of the internal iliac artery and its branches;
- (ii.) The external iliac glands which run by the side of the vessels of the same name;
- (iii.) The common iliac glands placed around the common iliac vessels and
- (iv.) The abdomino-aortic glands surrounding the lower part of the aorta and its vein.

The lymphatics draining the different organs are the tributaries of the glands and it is important to note that the latter are situated on the outer wall of the pelvis and so place no obstacle to the flow of lymph through the intricate system of vessels that surrounds the uterus and its adnexa.

The lymphatics of the vagina originate in a fine network of vessels in the mucosa which communicate freely with a similar arrangement in the muscular layer and these in turn anastomose with a perivaginal network which is drained by three groups of collecting trunks into the pelvic glands. (a) The inferior group collecting the lower third of the vagina, runs in front of the sacrum to the glands at the promontory. (b) The middle group runs obliquely up and back from the middle third of the vagina into the hypogastric glands. (c) The superior group runs from the upper third of the vagina transversely to the external iliac glands. The meshes of these networks of lymphatics communicate freely with those of the vulva below and the uterus above.

The lymphatics of the uterus also arise from three capillary networks, a mucous, a muscular and a peritoneal network. The trunks originating from these all assemble on the surface of the uterine muscle in the subperitoneal cellular tissue where they form by their anastomoses a fourth and final network from which the collecting trunks start. Those from the cervix drain by three pedicles into (i.) the external iliac, (ii.) the hypogastric glands and (iii.) the promontory glands *via* the utero-sacral ligaments. Those from the body drain by three

For the purpose of this paper special consideration should be given to the minute anatomy of the lymphatics of the uterus. By the injection of mercury the lymph current of this organ can be traced from its lacunar origin in the cervical and corporeal mucosa through minute funnel shaped ostia directly to the muscular layer. Here it branches into an extensive capillary net which, spreading on the perimysium, penetrates and enmeshes every bundle and fascicle of the entire uterine musculature to the subperitoneal surface where it is drained away

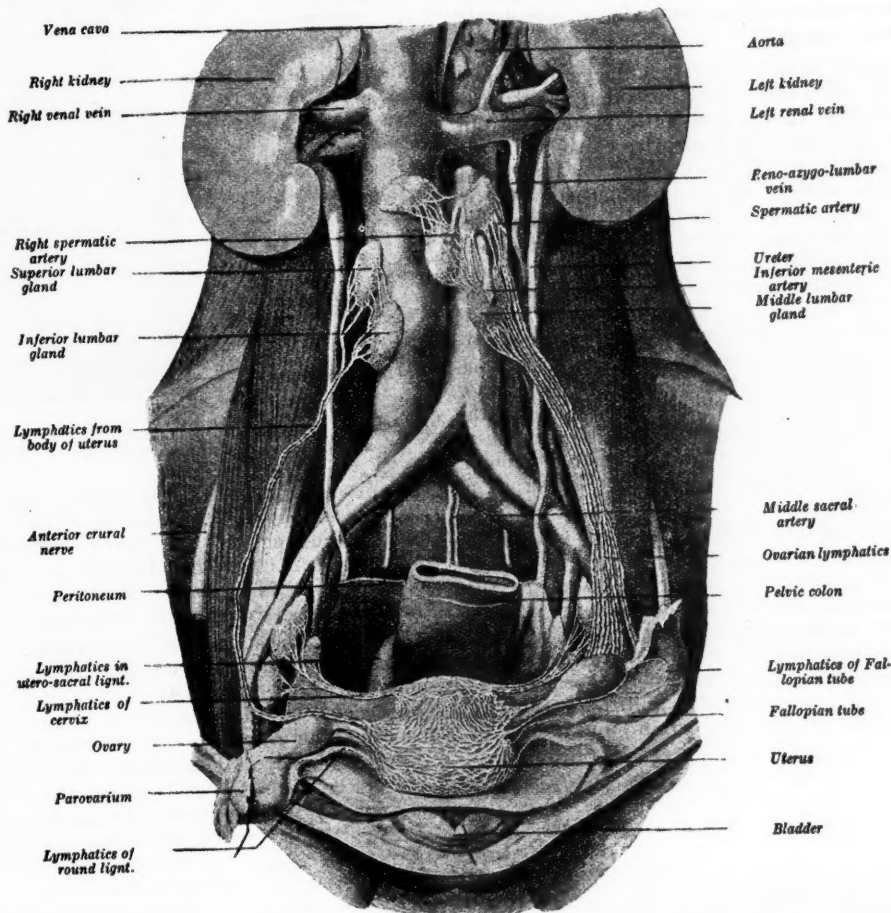


FIGURE I.
General View Showing the Lymphatics of the Internal Genital Organs of the Female.
(From Poirier.)

pedicles: (i.) The principal pedicle from the cornu along the terminal segment of the uterine artery where the lymphatics anastomose with those of the ovary and tube and then as satellites of the ovarian artery to the abdomino-aortic group of glands, (ii.) an accessory pedicle to the external iliac glands and (iii.) another single trunk to the inguinal glands.

The lymphatics of the ovaries and tubes arising from the three coats of these organs anastomose freely with each other and those of the principle uterine pedicle and share its mode of termination in the abdomino-aortic group of glands.

by the groups of lymphatic pedicles previously described. The lymphatics of the tubes and ovaries are drained by a very similar system. The fact must be ever kept before the mind that all these networks of lymph channels surrounding the internal genital organs of the female freely intercommunicate before draining away to their glandular destination.

It seems passing strange that knowing so well the red lined lymphangitis of the arm arising from a septic skin affection of the hand or a furuncle, the lymphatic spread to the inguinal glands from

chancre or ulcer of the external genital organs, the lymphatic spread originating from the infective processes of the throat and elsewhere, gynaecologists should have so long overlooked the similarity of function of the pelvic lymphatics and their importance as one of the avenues of spread of subacute and chronic pelvic infective processes. This is all the more peculiar since the importance of the lymphatic channels in the dissemination of malignant disease of the uterus has been long recognized. In spite of this well-established fact their dominating rôle in the general pathology of certain types of gynaecological infection has been almost completely ignored until recently.

As Sturmdorff says, the cervix is the genital tonsil and in it as elsewhere every infection incites the greatest reaction in its lymphatic system; as an instance of the enormous resorptive capacity of the uterus he points out that displayed in its gravid and puerperal state. He also emphasizes that it is not the laceration of the cervix in labour as such, but the incidence of its infection that determines the morbidity. It is easily understood that whether an infection enters rapidly through a laceration, such as occurs in puerperal conditions, or slowly through the intercellular cement of the basement membrane of the racemose glands, as in chronic gonorrhœal infection of the cervix, the principles underlying the origin of the cervical lymphangitis and its spread are the same, although the intensity and rapidity of its extension may be greater through a laceration than through the intact lining of a racemose gland.

In the study of this subject I propose to exclude puerperal infections and to consider the non-puerperal ascending infections of a chronic nature, for to include all types would provide too large a scope for the time at my disposal, but still I wish to emphasize the fact that the general principles underlying invasions of the female pelvic organs are similar in both non-puerperal and puerperal infections, except that the origin and bulk of

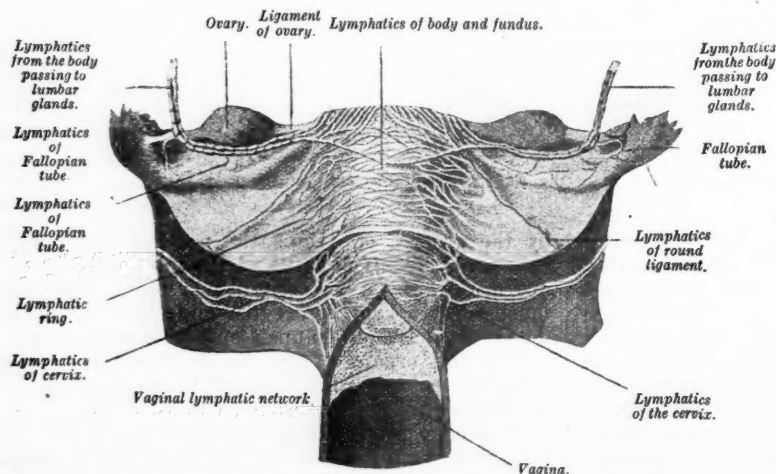


FIGURE III.
Lymphatic Vessels of the Uterus (from Poirier).

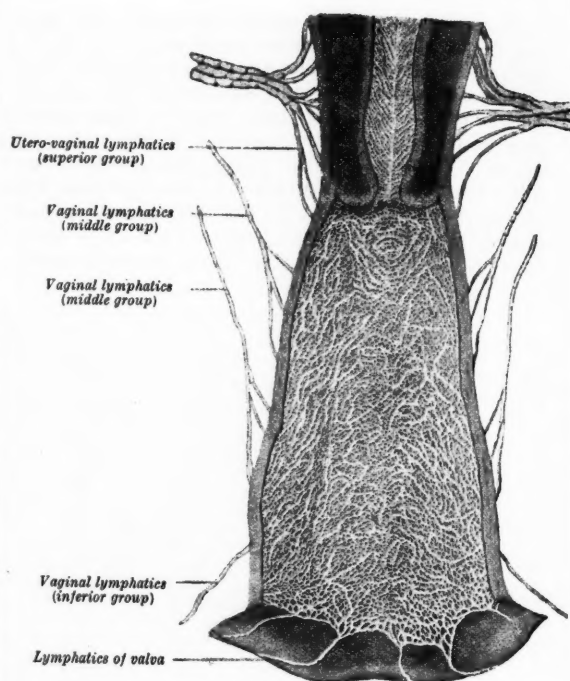


FIGURE II.
Lymphatic Network of the Mucous Membrane of the Vagina with their Efferent Trunks (from Poirier).

the process in puerperal cases takes place at the placental site in the body of the uterus and affects chiefly the veins, whereas in the non-puerperal cases the picture is mainly focussed on the cervix as the point of entrance of the infection and affects chiefly the lymphatics.

The commonest ascending organism is the gonococcus and its area of lymphatic spread, although more silent, is widest in extent, but as with the gonococcus, so with the streptococcus, the staphylococcus, the *Bacillus coli communis* and other organisms the extent of invasion of the lymphatic system, as in other parts of the body, is dependent on the virulence of the organisms and the resistance of the host.

Now let us consider the mode of invasion of the gonococcus which is typical of all other invading organisms, the differences being merely of degree due as stated above to their varying states of virulence at different times as well as the degree of resistance which they meet with on the part of the host.

All are familiar with the early stages of acute gonococcal invasion, and the urethra, the vulva, vagina, and cervix are red and inflamed, but this

hyperæmia soon passes off and the infection settles down in the areas where mucous glands are concentrated, namely, Skene's glands, Bartholin's glands and the racemose glands of the cervix, the vagina having no glands and being lined by stratified epithelium, soon casts off the infection. The first two sites are easy of access and with a little care and attention can be cleared, but not so with the cervix with its maze and network of deeply penetrating racemose glands into which the organisms quickly make their way to the deepest recesses. The internal os usually, but not always, offers an obstruction to the entrance of the gonococci into the uterus. Wertheim has shown that at times neither the internal os nor the isthmus of the uterine part of the tube stops the progress of gonococci in an apparently localized cervical gonorrhœa and quotes the condition of five patients in whom the adnexa were normal and in whom there were no subjective symptoms of an affection of the endometrium. He curetted particles from the *corporis mucosa* and examination of the sections revealed gonococci in all.

Amongst the causes which allow the cocci into the uterine cavity are menstruation, a time when the internal os relaxes, over-activity such as dancing, excess in coitus and love-making with its static flooding of the pelvis, the use of a sound, the use of the curette and the puerperium. After gonococci pass the internal os they generally

stop at the tubal ostia, but the same causes mentioned above may allow them to pass to the tubes for the cocci of themselves are non-mobile. Thus it may be clearly understood that under the above circumstances and in acute fulminating cases of gonorrhœa the organism does become a surface traveller and passes through the body of the uterus, causing a temporary endometritis *en route* to the Fallopian tube, but that far more commonly the gonococcus as well as non-venereal organisms remain below the internal os and concentrate their attention on the racemose glands of the cervix, causing chronic endocervicitis and an accompanying lymphatic absorption, at first mainly along the lymphatics of the utero-sacral ligaments, a fact which is the principal cause of the sacral backache in endocervicitis of all types. Should the host manufacture sufficient antibodies to overcome the organisms and their toxins, the endocervicitis disappears in a few weeks and the case comes under the heading of a mild gonorrhœa. If, on the other hand, the host fails in this quick

systematic defence, the organisms penetrate the basement membrane of the racemose glands and make their way into the lymphatic lacunæ. That this invasion of the lymphatic channels does occur is amply demonstrated by the slides shown, groups of gonococci are seen long distances from the lumen of the glands of the cervix (see Figure XIII).

These pathological exhibits are of particular importance in view of the heated and long standing controversy between Bumm, of Berlin, and Wertheim, of Vienna, concerning the relationship of the gonococcus to the tissue on which it is implanted. Bumm always maintained that the gonococcus is a parasite growing on the superficial layers of the various mucosæ and that the increase of the leucocytes and the rich infiltration of the intergranular and subepithelial connective tissue as well as the round-celled infiltration of the underlying muscular layer, occasionally observed, is due to distant action of the cocci which never under any circumstances penetrated as far as these tissues.

Wertheim, on the other hand, claimed that in almost all cases gonococci pass through the cement between the epithelial cells down to the connective tissue of the mucosa, even between the muscle bundles. Of eighteen uteri removed for gonorrhœal disease of the adnexa, in eight gonococci were still present in the secretion of the uterus. He found gonococci in groups in the

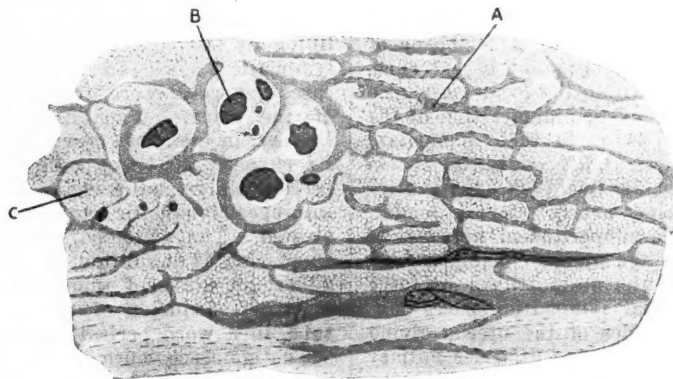


FIGURE IV.
Injection Specimen, Normal Nulliparous Uterus, Transverse Section of Myometrium.
A, Lymphatics running on the intra-muscular Septa and Enveloping the Muscle Bundles. B, Blood Vessels. C, Muscle Bundle (from Leopold).

epithelium and in the subepithelial tissue. In further proof that gonococci may enter the subepithelial connective tissue in any case, Wertheim has shown that they are found, for instance, in the subendothelial connective tissue of the peritoneum, in the bladder wall, in the wall of the vagina. Further, they have been found in the connective tissue of the synovia in gonorrhœal arthritis, down as far as the *muscularis* in prostatitis, also in *myocarditis gonorrhœa* and in *endocarditis gonorrhœa*.

The accompanying figures produce indisputable evidence that Wertheim was right in his claim that gonococci penetrated the tissue and that Bumm was wrong in his theory of the superficial action of these ubiquitous organisms. Wertheim also discovered gonococci in the sub-peritoneal connective tissue of the tubes, but he thought they had penetrated through the *muscularis* from the lumen of the tube. While not denying this possibility, I am of opinion that they are more frequently carried to this site from the cervix or occasionally from

the body of the uterus by the lymphatics which form the fourth network of sub-peritoneal lymphatic vessels surrounding the uterus. I have a preparation which proves that Wertheim's discovery was correct; it supports him in his controversy against Orthman Menge and others who were unable to find gonococci in the subepithelial tissue of the tubes.

On account of the free anastomosis of the network of lymphatics we can easily understand that once having penetrated into the lymph lacunæ of the cervix, the organisms have the whole area of the internal genitals to explore, for there are no glands to block their progress as these are situated on the outer wall of the pelvis. Thus can the extraordinary variety and location of inflammatory lesions of the female pelvis be explained. The particular site attacked would depend on three factors: (i.) the resistance of antitoxic mechanism of the host, (ii.) the number and virulence of the invading organism, (iii.) the direction in and rapidity with which they are carried along the vast network of lymph channels.

Let us consider the possibilities before gonococci which have penetrated the basement membrane of the racemose glands, the usual point of entrance. They might remain confined to the local lymphatic networks of the cervix causing inflammation of the musculature or cervicitis or to their immediate afferent vessels causing sacro-iliac cellulitis (back-ache) or a mild lymphangitis of the lymphatics accompanying the uterine artery (fornix tenderness) or pass along the subperitoneal network of lymphatics surrounding the uterus causing a perimetritis (subperitoneal uterine mottling) or force their way into myomesial lymphatic spaces surrounding the muscle bundles of the uterus giving rise to a metritis or even causing at times miliary abscesses of the uterine musculature. If the infection progresses, they will extend their activities and travel along the lymphatics accompanying the uterine arterial arch and so find their way to the perisalpingeal network causing perisalpingitis. Here again one of my illustrations proves this statement; in it will be seen a group of gonococci underneath the peritoneum covering the tube and separated from the mucosal lumen by the whole thickness of the muscular coat.

I believe that I have actually demonstrated by finding the organism *in situ* this mode of subperitoneal lymphatic invasion. This particular tube had no occlusion of the fimbriated end and the mucosa appeared healthy, the lesion was one of frank perisalpingitis. The chain of evidence of this particular case was complete. Gonococci were discovered intracellularly by Gram's staining in smears taken from the cervix. Gonococci were found in the cellular tissue below the basement membrane of the racemose glands in the enucleated endocervix and gonococci were found in the subperitoneal tissue of the tubes in the same case. No gonococci were found in the lumen of the tube or in the body of the uterus. Since I have made it my practice to enucleate the endocervix in cases of intractable endocervicitis, a large amount

of mucosal and submucosal cervical tissue has been available for microscopical examination and Dr. Leslie Utz has established a special method of preparing and staining sections of these tissues. He immerses the whole of the endocervix or tube in a solution of 10% "Formalin" (4% formaldehyde) to which just sufficient stain (methylene-blue or carbol-fuchsin) has been added to provide a distinct colouration without actual opacity. Frozen sections are then cut 5 μ in thickness and the sections are dried and mounted without clearing in any way. Throughout the preparation neither zylol, alcohol nor any clearing fluid is used and this fact accounts for the success with which the process has been attended. These clearing fluids in the old methods of preparing tissue for section dissolved the fats and allowed any organisms present to fall out of the spaces so created. By his method, we have discovered microscopically in more than a dozen cases gonococci in the cellular tissue of excised endocervices far removed from the lumen of the racemose glands. Thus have we shown the actual penetration of the basement membrane and of their columnar lining by the gonococci and their presence in the lymphatic lacunæ and lymph circulation. In all cases gonococci were discovered by Gram staining of the smears taken from the cervical canal. Besides, in the above cases as well as several others its capacity to travel along the network of subperitoneal lymphatic channels and to invade perisalpingeal lymphatic ramifications has been demonstrated. The gross pathological result of such wandering is inhibition of peristalsis, filamentous adhesions, kinks of tube with ectopic possibilities and even occlusion of the fimbriated ends of the tube, in a word perisalpingitis.

The gonococci once in the lymphatic circulation may wander to the ovary and the lymphatic infiltrate caused may thicken their capsules or *tunica albuginea* and prevent the normal rupture; resolution of the Graafian follicles in turn may ultimately give rise to retention cysts and the development of microcystic disease of the ovaries, a disease the aetiology of which baffled the gynaecologists of former days.

The above pathological facts are strong evidence that the mode of invasion of certain chronic pelvic infections is not *viâ* the uterine cavity as is usually supposed, but by an ascending lymphangitis which takes origin in a chronic endocervicitis resulting in infiltration and invasion of the whole uterine lymphatic system. According to the extent and direction of its spread this causes utero-sacral cellulitis, infiltration of the broad ligament lymphatics often with abscess formation, perimetritis and occasionally metritis with miliary abscesses of the myometrium, peri-salpingitis, ovarian cysts and abscesses, ovarian sclerosis, *fibrosis uteri* and many hitherto unexplained pathological lesions.

Personally I believe that both paths of invasion occur: (i.) *viâ* the uterine cavity in acute fulminating cases which result in general peritonitis or acute retort shaped pyo-salpingitis, (ii.) by the lymphatic circulation especially in chronic and sub-

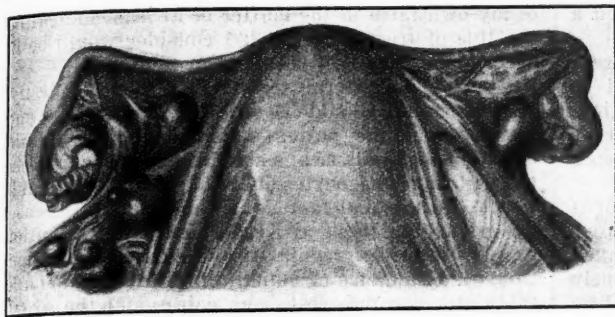


FIGURE V.
Thin Periadnexal Adhesions and Phlebectasia in the Broad Ligament, from Chronic Myometrial Lymphangitis, the Result of Chronic Endocervicitis (from Arnold Sturmdorf).

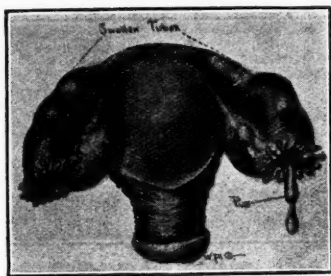


FIGURE VI.
Acute Purulent Salpingitis.
The tubes are greatly swollen and pus is seen exuding from one of the tubal ends. The fimbriae are swollen and have not reached the stage of adhesion and closure.

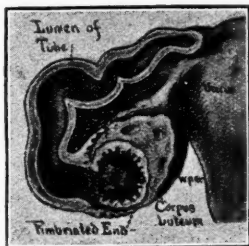


FIGURE VII.
Tubo-Ovaritis.
Diagram showing how an inflamed tube may become attached to the ovary and communicate its infection to the ovary through the opening of a corpus luteum.

acute infections, whether gonococcal, streptococcal or dependent on *Bacillus coli communis*. The pathological process naturally varies according to the type and virulence of the infection and the resistance of the tissues. In one case, as previously stated, it might be limited to the cervical mucous glands and the immediate surrounding tissues; again one can explain by this lymphatic theory of spread ovarian lesions occurring without any accompanying tubal involvement and anyone who has experienced the stiff, painful arm due to the inflamed lymphatics extending up from a septic hand, can imagine what a painful condition a simple

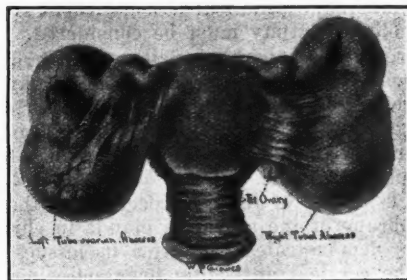


FIGURE VIII.
Right Tubal Abscess, Left Tubo-Ovarian Abscess.
On the right is a tubal abscess distinct from the ovary which is seen buried in adhesions. On the left the tube and ovary are involved in a common abscess, the ovarian portion of the sac being represented with a slightly scarred surface.



FIGURE IX.
Multiple Adhesions from Chronic Pelvic Inflammation.
This illustration represents a posterior view of the pelvic organs, with the intestinal coils pushed upward and to the sides to show the numerous perisalpingeal adhesions.

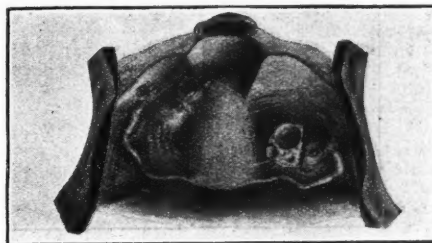


FIGURE X.
Cystic Ovary.
This affection is usually bilateral and the chronically inflamed and heavy ovary is often prolapsed.

peritubal and periadnexal lymphangitis must be. These constitute many of the cases diagnosed as salpingitis which get better without operation. In another case it might cause the infiltration and destruction of all the pelvic tissue, by extending *via* the subperitoneal lymphatics to the uterus and adnexa. Rarely does it extend as far as the glands which drain the pelvic system of lymphatics, as bubo-like swellings of these glands are never found even when the organs are greatly damaged. The one exception is the septic swelling of the glands which occasionally accompanies malignant ulceration of the uterus.

Finally, the practical lessons learnt from such a pathological study must be considered.

Every case of endocervicitis whether due to gonococci, *Bacillus coli communis*, staphylococci or other organisms should be treated seriously, just as we would a septic wound or septic throat in order to prevent the spread of the infection to the deeper lymphatic system.

The finding of the gonococci below the basement membrane of the racemose glands in chronic infections demonstrates the utter uselessness of much of the cervical antiseptic drug painting, so freely indulged in these days. I venture the definite opinion that the whole of the local treatment of the cervix as carried out to-day should be abandoned and that we should adopt a less meddlesome form of treatment.

of my own faith in the matter or at least indicating the line of treatment which I consider would be in accordance with the pathological findings.

As regards general treatment I believe, firstly, that the mind should be relieved of all worry and anxiety and the patient's general health should be attended to, all means should be used to increase the fighting phagocytes and antitoxic body fluids which are the real factors in the arrest of disease. These include fresh air, rest, light diet, attention to any digestive irregularities, the cure of constipation, an abundance of bland, unirritating fluids and especially absolute rest from coitus and the avoidance of any social relations or actions that tend to cause a static flooding of the pelvic organs, courtship, *et cetera*.

In regard to local treatment I believe that fre-

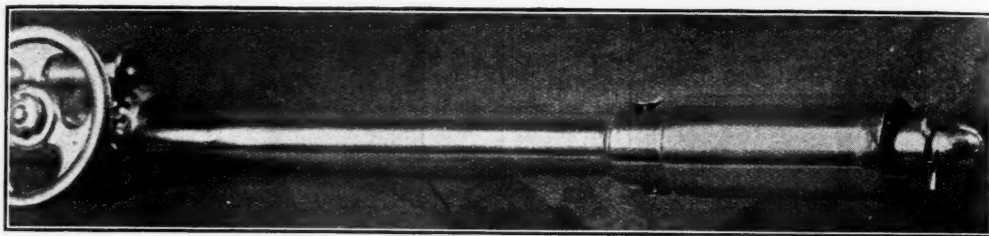


FIGURE XI.
Endocervical Enucleator (knife rotated downwards).

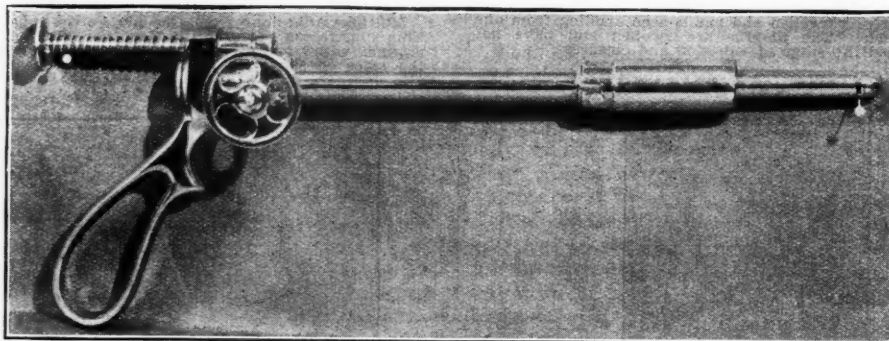


FIGURE XII.
Endocervical Enucleator (normal position).

The time honoured traumatism of curettage should be abandoned as a treatment for infective leucorrhœa, for the corporeal endometrium is rarely permanently affected and it is impossible to remove enough of the cervical mucosa to eradicate the infecting organism. Only when the disease has been arrested by the antitoxic action of the body fluids, may the curette be used to clear away any devitalized tissue left after the battle. No one would advise stirring up a dying bush fire, but the rake might be used to clear away some of the dead embers.

It would not be just for me to conclude this paper by destructive criticism of old and time honoured methods of treatment without making a confession

quent hot douches and occasional *Sitz* baths are beneficial in improving the pelvic circulation and removing excess of pus and epithelial *débris* from the vagina and in the intervals, the insertion of tampons saturated with glycerine combined with one or other of the many antiseptics on the market, occasional painting of the cervical mucosa by astringents, escharotics or antiseptics and packing of the canal with gauze soaked in glycerine and iodine after the thick plug of muco-pus has been removed by a Jene's syringe (Foreman). And I believe with Bucura that more attention should be given to general treatment by vaccines. His technique is as follows: (1) Fresh injections without mixed infections are given of one hundred to two hundred and fifty

million gonococci. If there be no reaction, a double dose is given after three to four days. If there be a reaction, the same dose is repeated after five to six days. The average scheme is to raise the initial doses from two hundred and fifty million to five hundred, seven hundred and fifty, one thousand and (highest) two thousand millions, the last highest dose is to be repeated at intervals from three to six days until there is not the slightest reaction.

In case of mixed infections the full dose of gonococcus vaccine is followed by a mixed vaccine; the first is one thousand million gonococci together with twenty million colon bacilli, two million streptococci, two hundred million staphylococci; this is raised to one thousand million gonococci, forty million colon bacilli, four million streptococci and four hundred million staphylococci; the respective doses are then raised to one thousand, eighty, eight and eight hundred million and then to maximal doses of one thousand, two hundred, twenty and one thousand millions.

If these intramuscular injections do not yield the desired effect, the injection is made into the tissue of the *portio*. The reaction here is quick and very severe.

I feel certain that one day some serum or drug will accomplish in the case of gonorrhœa what "Salvarsan" in syphilis and anti-diphtheritic serum in diphtheria does in those diseases. Absolute local cleanliness is a *sine qua non*.

Lastly, I believe that if an endocervicitis resists such treatment for from nine to twelve months, the endocervix should be enucleated. Such is my confession of faith in regard to the treatment of chronic and subacute ascending infections of the pelvic organs.

In conclusion I must thank Dr. Leslie Utz for the excellent sections he had made of tissues submitted to him and for the positive and practical proof that organisms do invade the connective tissue of the cervix and tubes. Further, I wish to pay a tribute to Dr. E. Morris Humphery for the excellent drawings and photomicrographs which he has made of the various sections submitted to him.

References.

- (1) C. Bucura: "Besonderheiten der weiblichen Gonorrhœe," *Wiener Medizinische Wochenschrift*, October 2, 9, 1926, Seite 1171 und Seite 1214.

DR. J. W. DUNBAR HOOPER (Melbourne) said that they were fortunate to hear such an excellent paper. There were too many women crippled by the after results of labour. They complained of pelvic discomfort and inability to perform their household duties. They were suffering from pelvic adhesions and mild inflammation resulting from cervical and vaginal injuries during birth and spreading along the lymphatics. Some time ago he had suggested to a London pathologist his theory of lymphatic spread. The pathologist had laughed at him, but later had agreed with his theory after carefully investigating this channel of infection. Any vaginal or cervical trauma would lead to a certain morbidity; later when pelvic lymphangitis had occurred, they forgot the original trauma. They did not finish with their maternity work on the tenth day of the puerperium. Pelvic lymphangitis might be brewing when they thought that all was well.

DR. C. NORTH (Dunedin) said that he wished there were time to discuss all the aspects of this subject. He would like to hear the opinion of other men on certain points. The first was cervical enucleation, the cutting out of the cervix to the level of the external os. The second was the question of the electric cautery and of fibrous contraction after its application. He also mentioned the reaction of aniline dyes in cervicitis. Methylene blue in glycerine he considered was valuable in the early stages. In the last place he asked for opinions in regard to the question of what should be done with the hypertrophied, irregular cervix when a hysterectomy was being performed. Should the surgeon cut out of the cervix from above.

DR. A. N. McARTHUR (Melbourne) said that there was a limit to the spread of infection from a damaged cervix; very frequently the infection did not go beyond the level of the internal os. It was difficult to understand, but nevertheless a clinical fact. The result was a chronic inflammation of the cervix, which gave women a large amount of psychological discomfort and pelvic pain. These patients obtained very little relief from local medical treatment. Lately in Sydney Dr. Schlink had enucleated the whole cervical canal with a special instrument. The removal of the cervix got rid of the inflammation, removal to the level of the internal os. Bleeding was considerable, but it could be controlled with care. He himself had been using diathermy with good results, but he had been compelled at times to perform enucleation afterwards in some patients.

PROFESSOR J. C. WINDEYER (Sydney) said he had seen Dr. Schlink using his enucleator and he used it quite easily; others had experienced difficulty. It was Dr. Schlink's own invention. They had not got within measurable distance of a decision in regard to the best method of treating the various forms of cervicitis. Hoffmeyer, of the Johns Hopkins Hospital, had been doing work on the pelvic lymphatics and the question of resistance of the pelvic cellular tissues. He was certain that Hoffmeyer's and Schlink's work would be invaluable.

DR. MARY DE GARIS (Geelong) advocated medical treatment of cervical infection. She had obtained good results. Surgery should be a last resort.

DR. F. R. RILEY (Dunedin) was very grateful to Dr. McArthur for so ably demonstrating the slides. Dr. Schlink's paper was a great lesson to them to avoid damage and so to prevent infection. He said that the sexual act late in pregnancy could cause infection. He had had no experience of cutting out the cervix, but he feared cicatricial results might ensue. He said that local treatment was tedious and often unsatisfactory and advocated amputation of the cervix.

Replying for Dr. Schlink Dr. McArthur said that Dr. Schlink's instrument was on view in the Pathological Museum with slides. He advocated medical treatment firstly with later surgical cutting out, if a cure had not resulted. The vessels must be tied securely after the cervix had been removed.

SECTION IV.—PATHOLOGY AND BACTERIOLOGY.

TUBERCULOUS LESIONS MET WITH IN EIGHT HUNDRED AUTOPSIES WITH DEDUCTIONS THEREFROM.

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Honorary Pathologist, Adelaide Hospital.

For some years past it has been the custom at the conclusion of every *post mortem* examination to record on a special card whether or not tuberculous lesions were present and if present their location and extent, together with the age and sex of the

patient, the birth place, the number of years of residence in Australia and any other pathological conditions present. Eight hundred of these cards have now been made out, comprising seven hundred and seventeen patients from the Adelaide Hospital, thirty-seven from the Adelaide Children's Hospital and forty-six from the Mental Hospital, Parkside. Amongst the Adelaide Hospital patients are included patients from the Infectious Diseases Block, the Consumptive Home and Cancer Block, as well as from the general wards. No selection has been made, *post mortem* examinations being carried out whenever permission was granted.

These eight hundred cases have now been analysed and the general results may be summarized in the following:

Total autopsies	800
No tuberculous foci detected	527 (66%)
Slight lesions present, possibly tuberculous	43
Tuberculous lesions present	230 (27.7%)
Healed, calcified tuberculous lesion	103 (13%)
Small quiescent or healing lesions	11
Extensive pulmonary tuberculosis	51
Extensive tuberculosis elsewhere than in the lungs	7
Tuberculous meningitis	6
Miliary tuberculosis	4
Pulmonary lesions, slight or semi-quiescent, deaths due to other causes	48

It may be well at the beginning to give a short summary of the inferences that it is thought may be drawn from this survey and of views that present themselves and demand serious consideration. These may be epitomized as follows:

1. Tuberculous lesions are less frequent in Australia than in Europe.

2. Nearly half of the tuberculous lesions detected were small and quite healed and in most cases cannot have given rise to any trouble or disturbance of health.

3. Healed, calcified tuberculous lesions of glands in the mesentery or glands in the thorax do not necessarily protect persons against fatal pulmonary tuberculosis.

4. The amount of healed, small, primary, tuberculous infections in the community shows a natural tendency for the patient's tissues to surround and overcome the tubercle bacilli. Immunity apparently does not here come in as the controlling agent, fibrosis being the limiting factor just as in silicosis.

5. There is considerable resemblance between the nature and distribution of the lesions due to tubercle bacilli and those due to toxic, non-immunity-producing colloid silica particles. The chief difference is that the tubercle bacilli multiply.

6. Tubercle bacilli, coal pigment and silica particles, all being non-motile, can be translocated in the body only by being carried along in a rush of fluid or in the body of an ingesting cell. Invasion of the lung tissues, the pharynx or the intestine is probably always by means of phagocytes.

7. Rapid proliferation of firm connective tissue around a group of tubercle bacilli can close all

avenues by which these organisms can escape either in a fluid stream or in the body of a phagocyte. The reaction is the same around silica particles. An immunity-response is not necessary to explain the reaction.

8. If we can devise means for speeding up this fibrous tissue reaction around the tubercle bacilli, then the figures under the heading "Healed Calcified Lesions" will be increased and those under "Active Lesions" reduced.

9. Calcification more readily occurs in my experience in necrosed tuberculous foci than in necrosed silicotic ones. Is this calcification helpful in imprisoning the tubercle bacilli in their fibrous tomb or is it purely a late deposit after the battle has been won?

10. Extensive tuberculous lesions in the lungs did not prevent in twenty cases out of fifty-one the successful inoculation by ingestion of a distant part of the body, namely the intestines. This is contrary to what one would expect from Koch's results on injecting tuberculous guinea pigs with tubercle bacilli.

11. In spite of the clinical evidence we have of tuberculin sensitization in tuberculous subjects (healed or active), there is no evidence in these *post mortem* findings clearly showing that the control of the tuberculous process has been due to an immunity response rather than a fibrosis unrelated to immunity. On the contrary there is considerable evidence that healed tuberculosis (a calcified area) does not necessarily protect against a later tuberculous development, whereas it would be expected that such persons would be immune, if immunity could be established.

12. Susceptibility to tuberculosis is probably due to the possession of a connective tissue which responds too slowly and too feebly to the presence of the tubercle bacilli in its neighbourhood, so that these have been carried further afield before fibrosis can wall them in. Families probably differ in this respect, individuals may differ from time to time (age, fatigue, poor food). The susceptibility of various animals may depend on this factor.

GENERAL CONSIDERATIONS.

Of the eight hundred *post mortem* records five hundred and twenty-seven or nearly 66% yielded no recognizable evidence of tuberculosis. It is probable that in a number of these slight lesions may have been overlooked and that in others lesions were present but were microscopic. It is quite clear, however, that if any of these individuals had ever been invaded by tubercle bacilli, the multiplication and activities of the organisms had been controlled at a very early stage, so that the damage done was negligible. From the point of view of disease such individuals must be considered as never having become tuberculous, though from the point of view of sensitization they would be expected to react to tuberculin administration. It would seem that the number of persons invaded by obvious

tuberculosis is much lower in Australia than in Britain or on the continent of Europe. This might be expected when the outdoor life led by so many in Australia is considered.

In two hundred and thirty *post mortem* examinations (28.7% of the cases) definite tuberculous lesions either active or obsolete were present. The balance of forty-three cases comprises those in which a little fibrosis or a gritty particle or some such indefinite lesion was detected. It is probable that in about half of these subjects the lesion had a tuberculous origin and that in the other half such was not the case. This may be considered a generous estimate as far as the lesions considered tuberculous are concerned. I may thus say that really five hundred and fifty of the eight hundred patients had no obvious tuberculous lesions even of the smallest size and that the remaining two hundred and fifty had tuberculous lesions, though many of these were very small.

Probably this represents fairly closely the incidence in the population at large. These autopsies have been performed with reasonably diligent search for small foci, such as calcareous specks in a bronchial gland. It is probable nevertheless that a considerable number of cases where gritty particles were present have been missed. It is probable also that in many instances a very small tuberculous focus, barely perhaps visible to the naked eye, may undergo fibrosis and healing without any caseation or calcification and thus might never be discovered. We must consider then this two hundred and fifty (or 31%) as being a minimum and that many others had still slighter infections which had been overcome.

The important thing is to note the prevalence of cases where the tuberculous lesion has been quite overcome, as evidenced by calcification. In many of these cases the tuberculous area has been exceedingly small. Why has the tubercle bacillus made so little advance in attacking these individuals and why at such an early stage in its invasion has it been overcome and routed? We cannot say that this is due to a previous infection having given rise to immunity, because then we should still have to explain how that previous infection had been overcome. Obviously either the dose of tubercle bacilli gaining entrance has been small, so that the tissues were able to overcome the multiplying organisms before they had extended too far, or else the individual tissue reaction has been of such a nature as to prevent the further advance of the tubercle bacilli. The tubercle bacilli are non-motile. They can only extend from the area where they happen to be deposited into surrounding parts by direct extension through tissue clefts, one bacillus pushing its fellow, so to speak, ahead of it, or by being washed along in the ebb and flow of fluid, or by being carried in the bodies of cells which have ingested them. Obviously if round a few tubercle bacilli you have rapidly built up a barrier of fibroblasts which quickly form fibrous tissue, this fibrous tissue as it contracts will obliterate all passages so that the tubercle bacilli have no clefts to grow along and no

currents can carry particles along and no phagocytes can squeeze through, with the result that the tubercle bacilli are imprisoned and can temporarily do no harm.

It seems highly probable that the reason why so many people, after having established a very slight tuberculous lesion in the lungs or in a lymph gland, have overcome such lesion, is on the one hand that the infecting dose of bacilli was small and on the other hand that their connective tissues were of a type that react readily in the shape of fibrous tissue formation to the foreign tubercle bacilli. An individual whose tissues react in this way particularly well, would be able to overcome a larger dose of tubercle bacilli than those individuals whose reaction was less effective and who might succumb to a much smaller infecting dose.

My analysis of the tuberculous cases will be confined to the two hundred and thirty in which the tuberculous nature of the lesion may be considered established. In one hundred and three of these, very nearly half of the infected individuals, the lesion was calcified and in some cases the area of calcification was no larger than half a grain of wheat. In other instances, as in the mesenteric glands, it was as large as a marble. The parts where these calcified areas were found, were the lungs and the lymph glands. In forty-eight cases various lymph glands were alone affected. In fifty-three lesions were present in the lungs. In two other cases healed tuberculosis of bone was found. Where calcification of the whole of the original tuberculous area had taken place, we may safely consider that the tubercle bacilli are dead and that complete cure has resulted. A few guinea pig inoculations from calcified glands or specks in the lung have failed to give rise to infection. Calcification also presupposes age in the lesion. I have found calcification in one person aged about twenty. Probably ten to fifteen years may be necessary for calcification to occur.

In eleven cases I have labelled the condition as being quiescent. The lesions were small; small areas of caseation were usually present and as these had not yet undergone calcification, it was thought that tubercle bacilli were probably still alive in the lesion though confined to it and prevented from escaping by more or less surrounding fibrosis. In forty-eight cases pulmonary lesions of an active nature were present; but these were not sufficiently extensive to be the immediate cause of death though they may have contributed to it. Sometimes such a lung condition was found unexpectedly at autopsy. In some cases the lesion may have been present for years and may have been more or less under control. Many of these patients would probably have lived a number of years longer, as far as tuberculosis as a cause of death was concerned, and would probably not have died from the tuberculosis.

In fifty-one instances active and extensive pulmonary tuberculosis was present, probably without exception affecting both lungs and in nearly all the instances this has been responsible directly or in-

directly for death; if in one or two instances it was not actually responsible for death the tuberculosis would have slain the patient very shortly if it had not been anticipated by some other disease.

I found that twenty of these fifty-one examples of extensive pulmonary tuberculosis were associated with tuberculous ulceration of the intestines, that is in very nearly half sufficient tubercle bacilli are swallowed to give rise to infection of the small or large intestine.

Tuberculous meningitis does not seem a common ending in extensive pulmonary tuberculosis, as only one patient had so died. I find, however, that two more patients who died from tuberculous meningitis, had small foci in the lung.

It is important to ascertain the tuberculous lesions elsewhere which are associated with extensive pulmonary tuberculosis. The table shows in detail these associated lesions. The important ones for our consideration are tuberculous lesions in glands at the root of the lung or in the mediastinum and tuberculosis of lymphatic glands elsewhere. Was the lung lesion a primary condition and the gland tuberculosis secondary or was the gland tuberculosis primary and the pulmonary tuberculosis an eventual extension from the gland or do the two sets of lesions represent independent invasions? Or if the pulmonary lesions have been due to a second invasion, have they been modified by the previous glandular invasion either in the shape of being made more aggressive or in the other hand less aggressive and more easily controlled?

Of the fifty-one cases of extensive pulmonary tuberculosis, only eighteen showed involvement of the glands; those in the thoracic cavity in ten and those of the mesentery in eight. Obvious glandular tuberculosis of the draining thoracic glands is found only in a small proportion of cases of pulmonary tuberculosis. It is to be noted, however, that the number here given is small and it is probable that in recording the results I have not taken special care, when once tuberculosis of the lungs has been established, to search the glands at the root for small secondary foci. The actual number of infected thoracic glands was probably higher than the figure here given. In five cases there were calcified mesenteric glands and in another six cases calcification in thoracic glands. Calcification means old lesions, probably in many cases due to infection in childhood. The patients died often in old age. Probably in these cases of calcification the gland tuberculosis had long preceded the pulmonary. I may safely say then that in eleven of the fifty-one cases of extensive pulmonary tuberculosis, that is in approximately 22% of such cases, there is evidence of very old and healed tuberculosis in the shape of calcified glands and that these calcified glands are nearly as likely to be met with in the mesentery as in the thorax. In spite of the body having been able to overcome completely these early infections, pulmonary tuberculosis had eventually established itself and caused death. Why did not the early infection produce immunity? Possibly some immunity had been established, but an overwhelming infection by in-

haled bacilli had got beyond control. The probability that the early infections were of bovine origin and the later pulmonary lesions of human origin may also help to explain the latter infection.

It must also be remembered that accidental circumstances such as a bursting of the caseous area in a certain direction, say into a bronchus, or an overwhelming infection or the adjuvant action of silicotic particles or temporary slight inflammatory lesions, such as bronchitis and broncho-pneumonia, may facilitate the progress of a tuberculous lesion in the lung even in a person whose tissues are reacting vigorously to the invasion. The disease in this way may always be getting ahead of the factors which are tending to circumscribe it. Thus it may happen that those patients who had the old tuberculous lesions which had healed, had a type of connective tissue which responded well in the shape of fibrosis to the tuberculous invasion. The sum of these accidental factors had, however, enabled tubercle bacilli to become established in their lungs and though the connective tissue of their lungs was reacting better and more actively than in the case of more susceptible individuals with a poorer connective tissue reaction, nevertheless the initial gain by the tubercle bacilli had never been overtaken.

Seven patients died with extensive tuberculosis which was not pulmonary or specially pulmonary in origin. To this same category may be added the four examples of miliary tuberculosis and the six with tuberculous meningitis. Thus sixty-eight of the two hundred and thirty patients with tuberculous infection died or were about to die of their tuberculosis. In fifty-one of these the lesions were essentially pulmonary and in the other seventeen they were not essentially situated in the lungs.

It is possible that we may be laying too much stress upon immunity reactions and sensitization in explaining the progress and pathological reactions met with in tuberculosis. It seems to me that the tuberculous process is very similar to that seen in connexion with small particles of silica in silicosis. These small colloid particles are a protoplasmic poison and give rise to necrosis with later surrounding fibrosis. No anti-substances of any kind can be produced against the colloid silica particles and sensitization to them cannot take place. The tubercle bacillus manufactures obviously a chemical body capable of causing necrosis with surrounding fibrosis. The essential difference between the silica particle and the tubercle bacillus is that the latter is living and can multiply and the former cannot. Each is ingested by phagocytizing cells. By means of these cells they are probably chiefly distributed. They kill these cells and then the dead cells and their contents are taken up by other cells and so the process is repeated. The tubercle bacillus has been meanwhile multiplying so that the amount of damage done is much greater eventually than from the silica particles. The most likely means for the arrest of the tuberculous extension would be the rapid formation of fibrous tissue sealing up the tubercle bacilli.

(To be continued.)

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